

New Chapter 130. Texas Essential Knowledge and Skills for Career and Technical Education

Subchapter P. Transportation, Distribution, and Logistics

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Text of Adopted New 19 TAC

New Chapter 130. Texas Essential Knowledge and Skills for Career and Technical Education

Subchapter P. Transportation, Distribution, and Logistics

§130.441. Implementation of Texas Essential Knowledge and Skills for Transportation, Distribution, and Logistics, Adopted 2015.

- (a) The provisions of this subchapter shall be implemented by school districts beginning with the 2017-2018 school year.
- (b) No later than August 31, 2016, the commissioner of education shall determine whether instructional materials funding has been made available to Texas public schools for materials that cover the essential knowledge and skills for career and technical education as adopted in §§130.442-130.464 of this subchapter.
- (c) If the commissioner makes the determination that instructional materials funding has been made available under subsection (b) of this section, §§130.442-130.464 of this subchapter shall be implemented beginning with the 2017-2018 school year and apply to the 2017-2018 and subsequent school years.
- (d) If the commissioner does not make the determination that instructional materials funding has been made available under subsection (b) of this section, the commissioner shall determine no later than August 31 of each subsequent school year whether instructional materials funding has been made available. If the commissioner determines that instructional materials funding has been made available, the commissioner shall notify the State Board of Education and school districts that §§130.442-130.464 of this subchapter shall be implemented for the following school year.

§130.442. Principles of Transportation Systems (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) In Principles of Transportation Systems, students will gain knowledge and skills in the safe application, design, production, and assessment of products, services, and systems. This knowledge includes the history, laws and regulations, and common practices used in the transportation industry. Students should apply knowledge and skills in the application, design, and production of technology as it relates to the transportation industries. This course allows students to reinforce, apply, and transfer their academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) identify career development and entrepreneurship opportunities related to transportation systems;
 - (B) identify careers in transportation systems;
 - (C) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation within transportation;
 - (D) discuss certification opportunities;
 - (E) demonstrate knowledge of personal and occupational health and safety;
 - (F) discuss response plans to emergency situations;
 - (G) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and
 - (H) explore career goals, objectives, and strategies as part of a plan for future career opportunities.
- (2) The student develops leadership experience as it relates to transportation systems. The student is expected to:
 - (A) plan, propose, conduct, and evaluate industry-based occupational experiences;
 - (B) apply proper record-keeping skills as they relate to industry-based occupational experiences;
 - (C) use a customized record-keeping system for the individual industry-based occupational experiences;
 - (D) discuss youth leadership opportunities to create a well-rounded industry-based occupational experience; and
 - (E) develop a work plan and budget.
- (3) The student explores concepts related to cultural diversity. The student is expected to:
 - (A) identify significant similarities and differences in international culture;
 - (B) explain the variety of world markets; and
 - (C) describe marketing factors and practices that impact other cultures.
- (4) The student understands the historical, current, and future significance of the transportation industries. The student is expected to:
 - (A) define terms associated with the transportation industries;
 - (B) identify the scope and effect on society of the transportation industries;
 - (C) identify significant historical and current developments in the transportation industries;
 - (D) identify potential future development for transportation industry systems;
 - (E) describe how emerging technologies and globalization impact the transportation industries; and
 - (F) compare and contrast issues affecting the transportation industries such as international trade, employment, safety, and environmental issues.
- (5) The student analyzes the structure of transportation organizations. The student is expected to:
 - (A) describe common business management principles;

- (B) identify opportunities for leadership development and personal growth;
 - (C) demonstrate democratic principles in conducting effective meetings;
 - (D) describe team dynamics; and
 - (E) describe the development of organizational vision, mission, and goals through the strategic planning process.
- (6) The student explains the transportation industries at the local, state, national, and international levels. The student is expected to:
- (A) identify reasons for world trade and globalization;
 - (B) identify the political impact of transportation;
 - (C) review regulations and major laws and evaluate their impact on transportation;
 - (D) read appropriate written material to stay abreast of current issues impacting transportation;
 - (E) collect public opinion and data in order to make informed decisions;
 - (F) use critical-thinking skills to identify and organize alternatives and evaluate public policy issues related to transportation; and
 - (G) evaluate performance and contract compliance of contractors and service providers.
- (7) The student demonstrates appropriate interpersonal and communication skills. The student is expected to:
- (A) examine workplace ethical and legal responsibilities;
 - (B) define the uses of proper etiquette;
 - (C) identify appropriate personal appearance and health habits;
 - (D) practice written and oral communication skills in formal and informal situations;
 - (E) practice effective listening skills in formal and informal situations;
 - (F) read and comprehend materials common to the transportation industry;
 - (G) employ writing and preparation skills using technical information; and
 - (H) demonstrate speaking skills.
- (8) The student applies appropriate research methods for transportation systems. The student is expected to:
- (A) define major fields of research and development;
 - (B) identify and apply scientific methods of research in transportation industries;
 - (C) use a variety of resources for research and development; and
 - (D) describe the scientific methods of research.
- (9) The student applies problem-solving, mathematical, and organizational skills in order to maintain financial and logistical records related to transportation. The student is expected to:
- (A) discuss project proposals;
 - (B) maintain records appropriate to transportation system industries;
 - (C) collect and organize data in graphs, tables, charts, and plots; and
 - (D) analyze and interpret data from graphs, tables, charts, and plots.
- (10) The student uses information technology tools specific to transportation industries to access, manage, integrate, and create information. The student is expected to:

- (A) use management software, email applications, and Internet applications;
 - (B) use word-processing, database, spreadsheet, and presentation software;
 - (C) examine collaborative, groupware, and virtual meeting software; and
 - (D) discuss Geographic Information Systems, Global Positioning Systems, and other computer-based equipment in transportation systems.
- (11) The student discusses methods to reduce workplace hazards in order to promote a safe working environment. The student is expected to:
- (A) discuss safe work practices and emergency procedures;
 - (B) identify rules and laws designed to promote safety and health in transportation environments;
 - (C) demonstrate first aid and cardiopulmonary resuscitation procedures;
 - (D) demonstrate proper use of safety equipment; and
 - (E) evaluate worksite safety areas and/or plans.
- (12) The student examines Texas Department of Public Safety regulations as related to the transportation industry. The student is expected to:
- (A) discuss rules pertaining to obtaining a commercial driver license (CDL);
 - (B) explain the different types of CDLs;
 - (C) discuss the various endorsements available for a CDL;
 - (D) discuss the requirements for each endorsement;
 - (E) identify material handling and storage equipment and forklifts, including electric- and fuel-powered forklifts; and
 - (F) identify types of transportation that supply warehouses and distribution centers.

§130.443. Principles of Distribution and Logistics (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) In Principles of Distribution and Logistics, students will gain knowledge and skills in the safe application, design, production, and assessment of products, services, and systems. This knowledge includes the history, laws and regulations, and common practices used in the logistics of warehousing and transportation systems. Students should apply knowledge and skills in the application, design, and production of technology as it relates to distribution and logistics industries. This course allows students to reinforce, apply, and transfer their academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

- (A) identify career development and entrepreneurship opportunities in distribution and logistics;
- (B) identify careers in distribution and logistics systems;
- (C) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in distribution and logistics;
- (D) discuss certification opportunities;
- (E) demonstrate knowledge of personal and occupational health and safety;
- (F) discuss response plans to emergency situations;
- (G) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and
- (H) explore career goals, objectives, and strategies as part of a plan for future career opportunities.

(2) The student develops leadership experience as it relates to distribution and logistics systems. The student is expected to:

- (A) plan, propose, conduct, and evaluate industry-based occupational experiences;
- (B) apply proper record-keeping skills as they relate to industry-based occupational experiences;
- (C) use a customized record-keeping system for the individual industry-based occupational experiences;
- (D) discuss youth leadership opportunities to create a well-rounded industry-based occupational experience; and
- (E) develop a work plan and budget.

(3) The student explores concepts related to cultural diversity. The student is expected to:

- (A) identify significant similarities and differences in international culture;
- (B) explain the variety of world markets; and
- (C) describe marketing factors and practices that impact other cultures.

(4) The student understands the historical, current, and future significance of the distribution and logistics industries. The student is expected to:

- (A) define terms associated with the distribution and logistics industries;
- (B) identify the scope and effect upon society of the distribution and logistics industries;
- (C) identify significant historical and current developments in the distribution and logistics industries;
- (D) identify potential future scenarios for the distribution and logistics industry systems;
- (E) describe how emerging technologies and globalization impact the distribution and logistics industries; and
- (F) compare and contrast issues affecting the distribution and logistics industries such as international trade, employment, safety, and environmental issues.

- (5) The student analyzes the structure of distribution and logistics organizations. The student is expected to:
- (A) describe common business management principles;
 - (B) identify opportunities for leadership development and personal growth;
 - (C) demonstrate democratic principles in conducting effective meetings;
 - (D) describe team dynamics; and
 - (E) describe the development of organizational vision, mission, and goals through the strategic planning process.
- (6) The student explains the distribution and logistics industries at the local, state, national, and international levels. The student is expected to:
- (A) identify reasons for world trade and globalization;
 - (B) identify the political impact of distribution and logistics;
 - (C) review regulations and major laws to evaluate their impact on distribution and logistics;
 - (D) read appropriate written material to stay abreast of current issues impacting distribution and logistics;
 - (E) collect public opinion and data in order to make informed decisions;
 - (F) use critical-thinking skills to identify and organize alternatives and evaluate public policy issues related to distribution and logistics; and
 - (G) evaluate performance and contract compliance of contractors and service providers.
- (7) The student demonstrates appropriate personal and communication skills. The student is expected to:
- (A) examine workplace ethical and legal responsibilities;
 - (B) define the uses of proper etiquette;
 - (C) identify appropriate personal appearance and health habits;
 - (D) practice written and oral communication skills in formal and informal situations;
 - (E) practice effective listening skills in formal and informal situations;
 - (F) employ writing and preparation skills using technical information; and
 - (G) demonstrate speaking skills.
- (8) The student applies appropriate research methods for distribution and logistics systems. The student is expected to:
- (A) define major fields of research and development;
 - (B) identify and apply scientific methods of research in distribution and logistics industries;
 - (C) use a variety of resources for research and development; and
 - (D) describe the scientific methods of research.
- (9) The student applies problem-solving, mathematical, and organizational skills in order to maintain financial and logistical records. The student is expected to:
- (A) discuss project proposals;
 - (B) maintain records appropriate to distribution and logistics system industries;
 - (C) collect and organize data in graphs, tables, charts, and plots; and
 - (D) analyze and interpret data from graphs, tables, charts, and plots.

- (10) The student uses information technology tools specific to distribution and logistics industries to access, manage, integrate, and create information. The student is expected to:
- (A) use management software, email applications, and Internet applications;
 - (B) use word-processing, database, spreadsheet, and presentation software;
 - (C) examine collaborative, groupware, and virtual meeting software;
 - (D) discuss Geographic Information Systems and Global Positioning Systems; and
 - (E) discuss other computer-based equipment in distribution and logistics systems.
- (11) The student discusses methods to reduce sources of workplace hazards in order to promote a safe working environment. The student is expected to:
- (A) discuss safe work practices and emergency procedures;
 - (B) identify rules and laws designed to promote safety and health in the distribution and logistics environments;
 - (C) demonstrate first aid and cardiopulmonary resuscitation procedures; and
 - (D) demonstrate proper use of safety equipment.
- (12) The student examines material handling in warehouses and distribution centers. The student is expected to:
- (A) discuss handling practices for goods and materials;
 - (B) explain size, weight, and shape requirements for packaging;
 - (C) discuss material handling, storage, and shipping methods;
 - (D) analyze visual design and appearance requirements for packages;
 - (E) discuss layout plans for processing packages;
 - (F) identify material handling and storage equipment; and
 - (G) identify types of warehouses and distribution centers.

§130.444. Introduction to Transportation Technology (One-Half Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one-half credit for successful completion of this course.
- (b) Introduction.
- (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation, infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Introduction to Transportation Technology includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. Transportation Technology includes applicable safety and environmental rules and regulations. In Transportation Technology, students will gain knowledge and skills in the repair, maintenance, and diagnosis of transportation systems. This study will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.

- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) demonstrate [demonstrates] the importance of workplace safety and environmental responsibilities and the use of personal protective equipment in transportation services;
 - (B) identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of transportation technology;
 - (C) demonstrate the principles of group participation and leadership related to citizenship and career preparation;
 - (D) identify employers' expectations and appropriate work habits; and
 - (E) discuss workplace ethics in a variety of scenarios.
 - (2) The student demonstrates academic skills related to the requirements of transportation technology. The student is expected to:
 - (A) demonstrate effective oral communication skills with individuals from various cultures such as fellow students, coworkers, and customers;
 - (B) demonstrate effective written communication skills with individuals from various cultures such as fellow students, coworkers, and customers; and
 - (C) demonstrate mathematical skills in performing addition, subtraction, multiplication, division, and measurements using the metric and U.S. customary systems.
 - (3) The student understands the technical knowledge and skills of basic transportation systems. The student is expected to:
 - (A) locate, read, and interpret transportation repair and service information; and
 - (B) describe the basic and emerging transportation technologies.
 - (4) The student knows the functions and applications of the tools, equipment, technologies, and materials used in transportation technology. The student is expected to:
 - (A) demonstrate awareness of the proper way to safely use hand and power tools and equipment commonly employed in the industry;
 - (B) identify diagnostic tools and equipment; and
 - (C) identify hand and shop tools and describe their proper usage.

§130.445. Small Engine Technology I (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related

professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

- (3) Small Engine Technology I includes knowledge of the function and maintenance [~~-, diagnosis, and service~~] of the systems and components of all types of small engines such as outdoor power equipment, [~~lawn mowers,~~] motorcycles, generators, and irrigation engines. This course is designed to provide training for employment in the small engine technology industry. Instruction includes the repair and service of cooling, air, fuel, lubricating, electrical, ignition, and mechanical systems [~~and small engine overhauls~~]. In addition, the student will receive instruction in safety, academic, and leadership skills as well as career opportunities.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
- (A) identify career development and entrepreneurship opportunities in the small engine technology industry;
 - (B) identify careers in the small engine technology industry;
 - (C) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the small engine technology industry;
 - (D) discuss certification opportunities;
 - (E) demonstrate skills and knowledge related to personal and occupational health and safety in the workplace;
 - (F) discuss response plans to emergency situations;
 - (G) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and
 - (H) develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities.
- (2) ~~(5)~~ The student demonstrates appropriate personal and communication skills. The student is expected to:
- (A) describe and demonstrate [~~apply~~] ethical and legal responsibilities for appropriate workplace conduct;
 - (B) demonstrate [~~define the uses of~~] proper etiquette and behavior;
 - (C) demonstrate [~~identify~~] appropriate personal appearance and hygiene [~~health habits~~];
 - (D) practice written and oral communication skills and employ effective listening skills;
 - ~~(E) comprehend technical reading materials common to the transportation industry;~~
 - (E) ~~(F)~~ employ technical writing and preparation skills; and
 - (F) ~~(G)~~ demonstrate effective speaking skills through prepared and extemporaneous oral presentations.
- (3) ~~(2)~~ The student describes the historical, current, and future significance of the small engine technology industry. The student is expected to:

- (A) describe how emerging technologies technology and their globalization impact on the small engine technology industry; and
- (B) identify compare and contrast issues affecting the small engine technology industry related to such as employment, safety, and environmental issues ; ;
- (C) 4(A) discuss review regulations and major laws and evaluate their impact on the small engine technology industry; and
- (D) 4(B) read appropriate written material to stay abreast of current issues impacting the small engine technology industry . ;
- (4) (3) The student participates in opportunities for leadership development and personal growth. analyzes the structure of the small engine technology industry organizations. The student is expected to:
- (A) participate in the planning and development of leadership and skill development activities such as conducting effective meetings, team building activities, and strategic planning; and
- (B) use resources available through an organization such as a career and technical student organization to develop employability skills.
- ~~(A) — describe common business management principles;~~
- ~~(B) — identify opportunities for leadership development and personal growth;~~
- ~~(C) — demonstrate democratic principles in conducting effective meetings;~~
- ~~(D) — describe team dynamics;~~
- ~~(E) — describe the development of organizational vision, mission, and goals through the strategic planning process;~~
- ~~(F) — develop a local program of activities for extended learning opportunities such as career and technical student organizations; and~~
- ~~(G) — summarize key information about the performance and use of resources within an organization such as a career and technical student organization.~~
- (5) (4) The student identifies the skills used to maintain and operate a small engine maintenance facility. explains the small engine technology industry at local, state, national, and international levels. The student is expected to:
- ~~(A) — review regulations and major laws and evaluate their impact on the small engine technology industry;~~
- ~~(B) — read appropriate written material to stay abreast of current issues impacting the small engine technology industry;~~
- ~~(C) — use critical thinking skills to identify and organize alternatives and evaluate public policy issues related to the small engine technology industry;~~
- ~~(D) — evaluate performance and contract compliance of contractors and service providers;~~
- (A) ~~(E)~~ perform develop and manage preventative maintenance schedule plans and systems to keep facility, tools, and equipment operating safely and properly;
- (B) ~~(F)~~ use the preventative assess preventive maintenance schedule of the plans to meet facility, tools, ~~[tool,]~~ and equipment to determine repair or replacement needs; design and manufacturer requirements;
- (C) ~~(G)~~ successfully complete repair orders and paperwork related to the small engine technology industry to properly document work needed or completed ;
- (D) ~~(H)~~ estimate parts and labor costs on repair orders for small engine repair; and

- (E) ~~(F)~~ locate, read, and interpret service repair information ~~[documents]~~ such as small engine schematics, charts, and service-repair manuals and bulletins, ~~and~~
- ~~(J) demonstrate knowledge of new and emerging technologies that may affect the service and repair of small engines.~~
- ~~(5) The student demonstrates appropriate personal and communication skills. The student is expected to:~~
- ~~(A) describe and apply ethical and legal responsibilities for appropriate workplace conduct;~~
- ~~(B) define the uses of proper etiquette and behavior;~~
- ~~(C) identify appropriate personal appearance and health habits;~~
- ~~(D) practice written and oral communication skills and employ effective listening skills;~~
- ~~(E) comprehend technical reading materials common to the transportation industry;~~
- ~~(F) employ technical writing and preparation skills; and~~
- ~~(G) demonstrate effective speaking skills through prepared and extemporaneous oral presentations.~~
- ~~(6) The student applies appropriate research methods on small engine technology topics to properly diagnose and repair. The student is expected to:~~
- ~~(A) define major fields of research and development;~~
- ~~(B) identify and apply scientific methods of research in the small engine technology industry;~~
- ~~(C) use a variety of resources for research and development;~~
- ~~(D) describe the scientific methods of research;~~
- ~~(E) evaluate scientific constructs such as conclusions, conflicting data, controls, data inferences, limitations, questions, sources of errors, and variables; and~~
- ~~(F) apply scientific methods through direct and indirect observation.~~
- (6) ~~(7)~~ The student applies problem-solving, mathematical, and organizational skills to maintain financial and logistical records. The student is expected to:
- (A) develop project proposals;
- (B) develop and maintain records appropriate to the small engine technology industry;
- ~~(C) collect and organize data in graphs, tables, charts, and plots;~~
- ~~(D) analyze and interpret data from graphs, tables, charts, and plots;~~
- ~~(E) maintain appropriate financial records such as management journals, inventories, income and expense logs, and financial statements and balance sheets;~~
- ~~(F) conduct formative, summative, and financial analyses on project learning objectives and records;~~
- (C) ~~(G)~~ describe mathematical formulas used to perform ~~[derive]~~ engine calculations such as calculating cylinder volume, engine displacement, combustion chamber volume, compressed head gasket volume, piston and deck height, piston dish volume, dome volume, cylinder volume, compression ratio, and horsepower;
- (D) ~~(H)~~ describe mathematical formulas used to perform ~~[derive]~~ electrical calculations such as calculating electrical resistance, current, and voltage in engines; and
- (E) ~~(I)~~ apply Ohm's law ~~[and power theory]~~ to small engine electrical circuits using a digital multimeter. ~~[engines; and]~~

- ~~(J)~~ apply electronic theory to generators, electric motors, power supplies, electronic amplifiers, electronic oscillators, and circuits found in engines.
- (7) ~~(8)~~ The student uses information technology resources ~~[tools]~~ specific to the small engine technology industry to access, manage, integrate, and create information. The student is expected to:
- (A) use personal management software such as email and Internet applications and word-processing, database, spreadsheet, presentation, collaborative, groupware, and virtual meeting software;
- (B) discuss Geographic Information Systems and Global Positioning Systems applications; and
- (C) use computer-based equipment.
- (8) ~~(9)~~ The student demonstrates an understanding of ~~[knows-advanced]~~ technical knowledge and skills of small engine technology. The student is expected to:
- (A) identify the use and application of small engines and their components;
- (B) identify the components of electrical-electronic systems;
- (C) demonstrate awareness of engine designs, components, and applications;
- (D) identify and use engine measuring tools and test equipment;
- (E) use tools used in the operation, maintenance, and repair of small engines;
- (F) compare and contrast the characteristics of two- and four-cycle engines; and
- (G) identify and discuss the functions of the major small engine components.
- (9) ~~(10)~~ The student applies [advanced] technical knowledge and skills in simulated or actual work situations. The student is expected to:
- (A) troubleshoot and repair small engines;
- ~~(B)~~ perform preventive maintenance on small engines;
- ~~(B)~~ ~~(C)~~ assess the proper fuel mixtures and analyze the efficiency of various fuels used in small engines;
- ~~(C)~~ ~~(D)~~ distinguish between valve arrangement positions and analyze valve timing with respect to crankshaft rotation;
- ~~(D)~~ ~~(E)~~ perform preventative maintenance and ~~[demonstrate the ability to maintain and]~~ service engine lubrication, cooling, starting, fuel, and ignition systems and associated fluids and filters; [such as lubrication, belts, cooling, crankcase breather, filter, starters, ignition, electronic, point, valve, and other systems;]
- ~~(E)~~ ~~(F)~~ perform routine installations, inspections, adjustments, and maintenance on small engines using [engine] testing tools and equipment;
- ~~(F)~~ ~~(G)~~ demonstrate knowledge of electrical testing tools and equipment commonly used in small engine maintenance;
- ~~(G)~~ ~~(H)~~ perform [collect] measurements using precision instruments;
- ~~(H)~~ ~~(I)~~ inspect and measure [evaluate] small engine parts for wear tolerances;
- ~~(I)~~ ~~(J)~~ explain the relationship between an electric current and magnetic fields in ignition, charging, and starting systems; and [using starters, generators, or electromagnets;]
- ~~(J)~~ ~~(K)~~ analyze the effects of heating and cooling on small engines . [;]
- ~~(L)~~ explain the thermophysical properties of fluid systems commonly used in small engines;
- ~~(M)~~ analyze electric circuits and electronic systems in small engines;

~~[(N) — define, analyze, and explain the laws of thermodynamics;]~~

~~[(O) — evaluate heat energy transfer in small engines;]~~

~~[(P) — calculate speed, momentum, acceleration, work, and power in small engines; and]~~

~~[(Q) — compare and contrast efficiency of various engine sizes and types.]~~

§130.446. ~~[Advanced]~~ Small Engine Technology II (Two Credits), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12 [9-12] . Prerequisite: Small Engine Technology. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

(3) ~~[Advanced]~~ Small Engine Technology II includes advanced knowledge of the function, diagnosis, and service of the systems and components of all types of small engines such as outdoor power equipment, [lawn mowers,] motorcycles, generators, and irrigation engines. This course is designed to provide hands-on and practical application [advanced training] for employment in the small engine technology industry. Instruction includes the repair and service of cooling, air, fuel, lubricating, electrical, ignition, and mechanical systems and small engine overhauls. In addition, students will receive instruction in safety, academic, and leadership skills as well as career opportunities.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the small engine technology industry;

(B) identify careers in the small engine technology industry;

(C) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the small engine technology industry;

(D) discuss certification opportunities;

(E) demonstrate skills and knowledge of personal and occupational health and safety in the workplace;

(F) discuss response plans to emergency situations;

(G) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills;

(H) develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities;

- (I) prepare a resume; and
- (J) demonstrate job interview skills.
- ~~(2)~~ ~~(6)~~ The student demonstrates appropriate personal and communication skills. The student is expected to:
- (A) describe ~~, demonstrate,~~ and apply ethical and legal responsibilities for appropriate workplace conduct;
- (B) demonstrate ~~[define the uses of]~~ proper etiquette and behavior;
- (C) demonstrate ~~[identify]~~ appropriate personal appearance and ~~hygiene~~ ~~[health habits]~~ ;
- (D) demonstrate effective ~~[practice]~~ written and oral communication skills and employ effective listening skills;
- ~~[(E) — comprehend technical reading materials common to the transportation industry;]~~
- ~~(E)~~ ~~[(F)]~~ demonstrate advanced ~~[employ]~~ technical writing and preparation skills; and
- ~~(F)~~ ~~[(G)]~~ demonstrate effective speaking skills through prepared and extemporaneous oral presentations.
- ~~(3)~~ ~~(2)~~ The student participates in opportunities for leadership development and personal growth. ~~[The student develops an occupational experience program as it relates to the small engine technology industry.]~~ The student is expected to:
- (A) participate in the planning and development of leadership and skill development activities such as conducting effective meetings, team building activities, and strategic planning; ~~[plan, propose, conduct, and evaluate industry based occupational experiences; and]~~
- ~~(B)~~ use resources available through an organizations such as a career and technical student organizations to develop employability skills; and
- ~~(C)~~ ~~[(B)]~~ record individual progress to document achievements. ~~[use a customized record-keeping system for the individual industry based occupational experiences.]~~
- ~~(4)~~ ~~(3)~~ The student describes the historical, current, and future significance of the small engine technology industry. The student is expected to:
- (A) describe ~~[how]~~ emerging technologies ~~[technology]~~ and ~~their~~ ~~[globalization]~~ impact on the small engine technology industry;
- (B) compare and contrast issues affecting the small engine technology industry ~~related to~~ ~~[such as]~~ employment, safety, ~~[and]~~ environmental ~~, and regulatory~~ issues; and
- (C) describe ~~local and global market conditions~~ ~~[marketing factors]~~ and practices that impact the application and need of the small engine technology industry. ~~[other cultures.]~~
- ~~[(4) — The student analyzes the structure of the small engine technology industry organizations. The student is expected to:]~~
- ~~[(A) — describe common business management principles;]~~
- ~~[(B) — identify opportunities for leadership development and personal growth;]~~
- ~~[(C) — demonstrate democratic principles in conducting effective meetings;]~~
- ~~[(D) — describe team dynamics;]~~
- ~~[(E) — describe the development of organizational vision, mission, and goals through the strategic planning process;]~~
- ~~[(F) — develop a local program of activities for extended learning opportunities such as career and technical student organizations; and]~~

- ~~[(G) — summarize key information about the performance and use of resources within an organization such as a career and technical student organization.]~~
- (5) The student identifies the skills used to maintain and operate a small engine maintenance facility.
~~[explains the small engine technology industry at local, state, national, and international levels.]~~
 The student is expected to:
- ~~[(A) — review regulations and major laws to evaluate their impact on the small engine technology industry;]~~
- ~~[(B) — read appropriate written material to stay abreast of current issues impacting the small engine technology industry;]~~
- ~~[(C) — use critical thinking skills to identify and organize alternatives and evaluate public policy issues related to the small engine technology industry;]~~
- ~~[(D) — evaluate performance and contract compliance of contractors and service providers;]~~
- (A) ~~[(E)]~~ develop, evaluate, and perform ~~[and manage]~~ preventative maintenance plans and systems to keep facility, tools, and equipment operating safely and properly;
- ~~[(F) — assess preventive maintenance plans to meet facility, tool, and equipment design and manufacturer requirements;]~~
- (B) ~~[(G)]~~ [successfully] complete repair orders and paperwork related to the small engine technology industry to properly document work needed or completed such as ensuring proper customer communication and authorization ;
- (C) ~~[(H)]~~ estimate parts and labor costs on repair orders for small engine repair;
- ~~[(D) — describe common business management principles such as technician productivity, shop efficiency, and profit margins; and]~~
- (E) ~~[(I)]~~ locate, read, and interpret service repair information [documents] such as small engine schematics, charts, and technical [service repair manuals and] bulletins ; [;and]
- ~~[(J) — demonstrate knowledge of new and emerging technologies that may affect the service and repair of small engines.]~~
- ~~[(6) — The student demonstrates appropriate personal and communication skills. The student is expected to:]~~
- ~~[(A) — describe and apply ethical and legal responsibilities for appropriate workplace conduct;]~~
- ~~[(B) — define the uses of proper etiquette and behavior;]~~
- ~~[(C) — identify appropriate personal appearance and health habits;]~~
- ~~[(D) — practice written and oral communication skills and employ effective listening skills;]~~
- ~~[(E) — comprehend technical reading materials common to the transportation industry;]~~
- ~~[(F) — employ technical writing and preparation skills; and]~~
- ~~[(G) — demonstrate effective speaking skills through prepared and extemporaneous oral presentations;]~~
- (6) ~~[(7)]~~ The student applies appropriate research methods to [or] small engine technology topics. The student is expected to:
- ~~[(A) — define major fields of research and development;]~~
- ~~[(B) — identify and apply scientific methods of research in the small engine technology industry;]~~
- (A) ~~[(C)]~~ use a variety of resources to research, trouble shoot, and diagnosis concerns and failures; and [for research and development;]

- (B) ~~(D)~~ describe the application of the scientific method of research to small engine technology such as identifying a problem, establishing a procedure, performing direct and indirect observation, collecting and interpreting data, and drawing conclusions by verifying the complaint, determining the related symptoms, analyzing the symptoms, isolating the trouble, correcting the trouble, and checking for proper operation. [;]
- ~~(E) evaluate scientific constructs such as conclusions, conflicting data, controls, data, inferences, limitations, questions, sources of errors, and variables; and]~~
- ~~(F) apply scientific methods through direct and indirect observation.]~~
- (7) ~~(8)~~ The student applies problem-solving, mathematical, and organizational skills to maintain financial and logistical records. The student is expected to:
- (A) develop project proposals;
- (B) develop and maintain records appropriate to the small engine technology industry;
- (C) collect and organize data in graphs, tables, and charts ~~[-and-plots]~~ ;
- (D) analyze and interpret data from graphs, tables, and charts ~~[-and-plots]~~ ;
- ~~(E) maintain appropriate financial records such as management journals, inventories, income and expense logs, financial statements, and balance sheets;]~~
- ~~(F) conduct formative, summative, and financial analyses on project learning objectives and records;]~~
- (E) ~~(G)~~ use mathematical formulas to perform ~~[derive]~~ engine calculations such as calculating cylinder volume, engine performance and enhancement, engine displacement, combustion chamber volume, compressed head gasket volume, piston and deck height, piston dish volume, dome volume, cylinder volume, compression ratio, and horsepower;
- (F) ~~(H)~~ use mathematical formulas to perform ~~[derive]~~ electrical calculations such as calculating and measuring electrical resistance, current, and voltage in engines;
- (G) ~~(I)~~ apply Ohm's law [and power theory] to small engine electrical circuits using a digital multimeter; and ~~[engines;]~~
- (H) ~~(J)~~ apply electrical principles to diagnose and repair small engine components such as ~~[electronic theory to]~~ generators, electric motors, power supplies, electronic amplifiers, relays, ~~[electronic oscillators;]~~ and circuits ~~;~~ [found in engines;]
- ~~(K) explain Newton's Law as it relates to engines; and]~~
- ~~(L) calculate Bernoulli's principle and Venturi effect as it relates to small engines.]~~
- (8) ~~(9)~~ The student uses information technology tools specific to the small engine technology industry to access, manage, integrate, and create information. The student is expected to:
- (A) use personal management software such as email and Internet applications and word-processing, database, spreadsheet, presentation, collaborative, groupware, and virtual meeting software;
- (B) discuss Geographic Information Systems and Global Positioning Systems applications; and
- (C) use other computer-based equipment.
- (9) ~~(10)~~ The student demonstrates ~~[knows]~~ advanced technical knowledge and skills of small engine technology. The student is expected to:
- (A) demonstrate ~~[identify]~~ the use and application of small engines and components;
- (B) demonstrate ~~[identify]~~ the components of electrical-electronic systems;
- (C) demonstrate knowledge of engine designs, components, and applications; and

(D) demonstrate the correct [~~identify and~~] use of engine measuring tools and test equipment ;

~~[(E) use tools used in the operation, maintenance, and repair of small engines;]~~

~~[(F) compare and contrast the characteristics of two and four cycle engines; and]~~

~~[(G) identify and discuss the functions of the major small engine components;]~~

(10) ~~[(H)]~~ The student demonstrates [~~applies~~] advanced technical knowledge and skills in simulated or actual work situations. The student is expected to:

(A) troubleshoot and repair small engines;

(B) perform preventative [~~preventive~~] maintenance on small engines;

(C) assess the proper fuel mixtures and analyze the efficiency of various fuels used in small engines;

(D) distinguish between valve arrangement positions and analyze valve timing with respect to crankshaft rotation;

(E) perform preventative maintenance and service engine lubrication, cooling, starting, fuel, and ignition systems and associated fluids and filters; [~~demonstrate the ability to maintain and service engine systems such as lubrication, belt, cooling, crankcase breather, filter, starter, ignition, electronic, point, valve, and other systems;~~]

(F) perform routine installations, inspections, adjustments, and maintenance on small engine testing tools and equipment;

(G) demonstrate knowledge of electrical testing tools and equipment commonly used in small engine maintenance such as digital multimeters ;

(H) perform [~~collect~~] measurements using precision instruments such as micrometers, dial indicators, and Vernier calipers ;

(I) inspect and measure [~~evaluate~~] small engine parts for wear tolerances and compare to specifications ;

(J) demonstrate [~~explain~~] the relationship between an electric current and magnetic fields in ignition, starting, and charging systems with the use of test equipment; [~~using starters, generators, or electromagnets;~~]

(K) analyze the effects of heating and cooling on small engines;

(L) explain the thermophysical properties of fluids [~~fluid systems~~] commonly used in small engine systems [~~engines~~] ;

~~[(M) analyze electric circuits and electronic systems in small engines;]~~

~~[(N) [(N)] [define, analyze, and] explain the laws of thermodynamics;~~

~~[(N) [(O)] explain torque, horsepower, and [evaluate] heat energy transfer in small engines;~~

~~[(O) [(P)] calculate speed [, momentum,] and acceleration [, work, and power] in small engines; and]~~

~~[(P) [(Q)] compare and contrast efficiency of various engine sizes and types.~~

§130.447. Automotive Basics [H] (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

- (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
- (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
- (3) Automotive Basics [I] includes knowledge of the basic [major] automotive systems and the theory and principles of the components that make up each system and how to service [diagnosing and servicing] these systems. Automotive Basics [I] includes applicable safety and environmental rules and regulations. In Automotive Basics [I], students will gain knowledge and skills in the repair, maintenance, and servicing [diagnosis] of vehicle systems. This study allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace such as safety glasses, other personal protective equipment (PPE), and safety data sheets (SDS);
 - (B) identify career and employment opportunities, including entrepreneurship opportunities, internships, and industry-recognized certification requirements for the field of automotive technology;
 - (C) demonstrate the principles of group participation, team concept, and leadership related to citizenship and career preparation;
 - (D) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the automotive technology industry;
 - (E) discuss certification opportunities;
 - (F) discuss response plans to emergency situations;
 - ~~[(A) demonstrate awareness of workplace safety and environmental responsibilities in automotive technology and understand the use of personal protective equipment;]~~
 - ~~[(B) identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of automotive services;]~~
 - ~~[(C) demonstrate the principles of group participation and leadership related to citizenship and career preparation;]~~
 - (G) [~~D~~] identify employers' expectations and appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and
 - (H) develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities.

- ~~(E)~~ discuss workplace ethics in a variety of scenarios.
- (2) The student demonstrates appropriate personal and communication skills. The student is expected to:
- (A) describe, demonstrate, and apply ethical and legal responsibilities for appropriate workplace conduct;
 - (B) demonstrate proper etiquette and behavior;
 - (C) demonstrate appropriate personal appearance and hygiene;
 - (D) demonstrate effective written and oral communication skills and employ effective listening skills;
 - (E) demonstrate advanced technical writing and preparation skills; and
 - (F) demonstrate effective speaking skills through prepared and extemporaneous oral presentations.
- (3) ~~(2)~~ The student demonstrates academic skills related to the requirements of automotive transportation technology. The student is expected to:
- (A) demonstrate effective oral communication skills with individuals from various cultures such as fellow students, coworkers, and customers;
 - (B) demonstrate effective written communication skills, including documenting on a repair order the customer concern/complaint, root cause of the failure, and corrective action to complete the repair; and [with individuals from various cultures such as fellow students, coworkers, and customers; and]
 - (C) demonstrate mathematical skills in performing addition, subtraction, multiplication, division, and measurements using decimals and fractions in the metric and U.S. standard systems as appropriate [customary systems] .
- (4) ~~(3)~~ The student understands the technical knowledge and skills of basic automotive systems. The student is expected to:
- (A) describe the eight major vehicle systems;
 - (B) locate, read, and interpret vehicle maintenance and service information; and
 - (C) describe the basic and emerging vehicle power systems.
- (5) ~~(4)~~ The student knows the functions and applications of the tools, equipment, technologies, and materials used in automotive services. The student is expected to:
- (A) demonstrate the proper way to safely use hand and power tools and equipment commonly employed in the maintenance and repair of vehicles;
 - (B) discuss the proper handling and disposal of environmentally hazardous materials used in servicing vehicles;
 - (C) identify diagnostic tools and equipment; and
 - (D) identify hand and shop tools and describe their proper usage.
- (6) ~~(5)~~ The student applies the technical knowledge and skills in simulated or actual [of the trade to] work situations. The student is expected to:
- (A) demonstrate the procedures for ordering and locating parts;
 - (B) demonstrate an understanding of the operation theory of internal combustion engines;
 - (C) identify brake [braking, steering, and suspension] system components, including drum, disc, power assist, and anti-lock braking system (ABS) ;

- (D) demonstrate an understanding of basic concepts related to hydraulic brakes systems, including Pascal's Theory of Hydraulics;
- (E) ~~(D)~~ demonstrate an understanding of basic concepts related to electrical and electronic systems such as Ohm's law, voltage drop, resistance, amperage, voltage, and wiring diagram symbols;
- (F) ~~(E)~~ identify air-conditioning, heating, and accessory system components ~~[systems]~~ ;
- (G) ~~(F)~~ inspect and identify chassis and power train components and systems;
- (H) ~~(G)~~ identify cooling and lubrication system components; ~~[systems components; and]~~
- (I) identify steering and suspension components, including power steering;
- (J) identify and interpret tire sidewall data information such as Department of Transportation (DOT) production date information, tire load capacity, inflation pressures, sizing description, and speed rating;
- (K) compare the preventative maintenance schedules for a variety of vehicles based on their use;
- (L) perform a preventative maintenance inspection;
- (M) explain and perform a "jump-start" of a vehicle using jumper cables and a booster battery or an auxiliary power supply according to manufacturer recommended procedures; and
- (N) ~~(H)~~ perform regular audits and inspections to maintain compliance with safety, health, and environmental regulations.

§130.448. Automotive Basics II (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Automotive Basics I. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

- (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
- (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
- (3) Automotive Basics II includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. Automotive Basics II includes applicable safety and environmental rules and regulations. In Automotive Basics II, students will gain knowledge and skills in the repair, maintenance, and diagnosis of vehicle systems. This study allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability and the theory of operation of automotive vehicle systems and associated repair practices.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

- (A) — identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of automotive technology;
 - (B) — demonstrate the principles of group participation and leadership related to citizenship and career preparation;
 - (C) — identify employers' expectations and appropriate work habits;
 - (D) — apply the competencies related to resources, information, systems, and technology as it pertains to automotive technology;
 - (E) — demonstrate awareness of the technical knowledge and skills related to health and safety in the workplace, as specified by appropriate governmental regulations; and
 - (F) — demonstrate workplace ethics in a variety of scenarios.
- (2) — The student demonstrates academic skills related to the requirements of transportation technology. The student is expected to:
- (A) — demonstrate effective oral communication skills with individuals from various cultures such as fellow students, coworkers, and customers;
 - (B) — demonstrate effective written communication skills with individuals from various cultures such as fellow students, coworkers, and customers; and
 - (C) — demonstrate mathematical skills in performing addition, subtraction, multiplication, division, and measurements using the metric and U.S. customary systems.
- (3) — The student demonstrates technical knowledge and skills that form the knowledge of basic automotive services. The student is expected to:
- (A) — describe the function of the major components of powered vehicles such as engines, fuel, lubrication, cooling, electrical, and air conditioning systems;
 - (B) — describe the function of the automotive chassis components such as braking, steering, transmission, drivetrain, and suspension systems;
 - (C) — locate, read, and interpret documents such as schematics, charts, diagrams, graphs, parts catalogs, and service repair manuals and bulletins;
 - (D) — perform precision measurements and use published specifications to diagnose component wear and determine necessary repairs; and
 - (E) — discuss alternative fuel vehicles.
- (4) — The student is aware of the functions and applications of the tools, equipment, technologies, and materials used in automotive technology. The student is expected to:
- (A) — discuss and demonstrate the safe use of hand and power tools and equipment commonly employed in the maintenance and repair of vehicles;
 - (B) — discuss the proper handling and disposal of environmentally hazardous materials used in servicing vehicles;
 - (C) — demonstrate awareness of new and emerging automotive technologies; and
 - (D) — identify and discuss the proper use of diagnostic tools and equipment.
- (5) — The student applies the technical knowledge and skills of the trade to work situations. The student is expected to:
- (A) — order, stock, and locate parts;
 - (B) — remove, repair, and replace engine components;
 - (C) — service and repair braking, steering, and suspension systems;
 - (D) — service and repair electrical/electronic systems;

- ~~(E) service and repair air conditioning, heating, and accessory systems;~~
- ~~(F) inspect, service, and repair chassis and power train components and systems;~~
- ~~(G) service and repair cooling and lubrication systems; and~~
- ~~(H) perform regular audits and inspections to maintain compliance with safety, health, and environmental regulations.~~

§130.449. Automotive Technology I : Maintenance and Light Repair (Two Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 9-12. **Recommended prerequisite: Automotive Basics.** Students shall be awarded two credits for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Automotive Technology I : **Maintenance and Light Repair** includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. **This course [Automotive Technology I]** includes applicable safety and environmental rules and regulations. In Automotive Technology I : **Maintenance and Light Repair**, students will gain knowledge and skills in the repair, maintenance, and diagnosis of vehicle systems. This study will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
 - (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace **such as safety glasses and other personal protective equipment (PPE) and safety data sheets (SDS); [-as specified by appropriate governmental regulations;]**
 - (B) identify **career and** employment opportunities, including entrepreneurship opportunities, and **internships and industry-recognized** certification requirements for the field of automotive technology;
 - (C) demonstrate the principles of group participation **,team concept,** and leadership related to citizenship and career preparation;
 - ~~(D) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the automotive technology industry;~~
 - ~~(E) discuss certification opportunities;~~
 - ~~(F) discuss response plans to emergency situations;~~

- ~~(G) identify employers' expectations and appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and~~
 - ~~(H) develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities.~~
 - ~~[(D) identify employers' expectations and appropriate work habits;]~~
 - ~~[(E) apply the competencies related to resources, information systems, and technology as it pertains to automotive technology;]~~
 - ~~[(F) demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace, as specified by appropriate governmental regulations; and]~~
 - ~~[(G) demonstrate workplace ethics in a variety of scenarios.]~~
- (2) The student demonstrates academic skills related to the requirements of automotive transportation technology. The student is expected to:
- (A) demonstrate effective oral communication skills with individuals from various cultures such as fellow students, coworkers, and customers;
 - (B) demonstrate effective written communication skills, including documenting on a repair order the customer concern/complaint, root cause of the failure, and corrective action to complete the repair; and [with individuals from various cultures such as fellow students, coworkers, and customers; and]
 - (C) demonstrate mathematical skills in performing addition, subtraction, multiplication, division, and measurements using decimals and fractions in the metric and U.S. standard systems as appropriate. ~~[customary systems.]~~
- (3) The student demonstrates [knows-the] technical knowledge and skills related to the manufacturer preventative maintenance schedule. ~~[that form the knowledge of automotive services.]~~ The student is expected to:
- (A) locate the manufacturer recommended preventative maintenance schedule;
 - (B) ~~[(A)]~~ perform a preventative maintenance inspection [describe the function of the major components] of vehicle systems, including engine, [powered vehicles such as engines,] fuel, lubrication, cooling, electrical, suspension, drive train, and air-conditioning systems;
 - (C) ~~[(B)]~~ describe the function of the automotive chassis components, including [such as] braking, steering, transmission, drive train, and suspension systems;
 - (D) ~~[(C)]~~ locate, read, and interpret service repair information [documents] such as schematics, charts, diagrams, graphs, parts catalogs, and technical [service repair manuals and] bulletins;
 - (E) ~~[(D)]~~ [perform precision measurements and] use published specifications to diagnose component wear and determine necessary repairs; [and]
 - ~~[(E) discuss alternative fuel vehicles.]~~
 - (F) identify the appropriate oil viscosity and capacity;
 - (G) verify operation of the instrument panel engine warning indicators;
 - (H) inspect engine assembly and document findings of fuel, oil, coolant, and other leaks;
 - (I) perform common fastener and thread repair, including removing broken bolt, restoring internal and external threads, and repairing internal threads with thread insert;
 - (J) inspect, replace, and adjust drive belts, tensioners, and pulleys;
 - (K) perform engine oil and filter change; and

- (L) explain and perform a "jump-start" of a vehicle using jumper cables and a booster battery or an auxiliary power supply according to manufacturer recommended procedures.
- (4) The student demonstrates [knows] the functions and applications of the tools, equipment, technologies, and materials used in automotive technology. The student is expected to:
- (A) demonstrate the proper [safety] use of hand and power tools and equipment commonly employed in the maintenance and repair of vehicles; and
- (B) discuss the proper handling and disposal of environmentally hazardous materials used in servicing vehicles . [3]
- ~~[(C) — demonstrate knowledge of new and emerging automotive technologies; and]~~
- ~~[(D) — identify and demonstrate the proper use of diagnostic tools and equipment.]~~
- (5) The student applies the technical knowledge and skills related to brakes in simulated or actual work [of the trade to work] situations. The student is expected to:
- (A) explains Pascal's Theory of Hydraulics as it relates to the brake system;
- (B) inspect brake system components, including master cylinder, brake lines, wheel cylinders, calipers, and flexible hoses and fittings, for external leaks and proper operation;
- (C) inspect, measure, and refinish brake drum diameter to manufacturer specifications;
- (D) remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates;
- (E) lubricate, reassemble, and pre-adjust brake shoes and parking brake;
- (F) remove, inspect for damage or wear, clean, lubricate, and reassemble pads and retaining hardware, caliper assembly, and mounting components such as slides and pins for proper operation;
- (G) refinish a rotor on and off a vehicle and measure final rotor thickness with manufacturer specifications;
- (H) retract and re-adjust caliper piston on an integral parking brake system;
- (I) check brake pedal travel with, and without, engine running to verify proper power booster operation;
- (J) check brake pedal travel with, and without, engine running to verify proper power booster operation;
- (K) check vacuum supply from a manifold or auxiliary pump to vacuum-type brake power booster; and
- (L) describe the operation of a regenerative braking system.
- ~~[(A) — order, stock, and locate parts;]~~
- ~~[(B) — remove, repair, and replace engine components;]~~
- ~~[(C) — service and repair braking, steering, and suspension systems;]~~
- ~~[(D) — service and repair electrical and electronic systems;]~~
- ~~[(E) — service and repair air conditioning, heating, and accessory systems;]~~
- ~~[(F) — inspect, service, and repair chassis and power train components and systems;]~~
- ~~[(G) — service and repair cooling and lubrication systems; and]~~
- ~~[(H) — perform regular audits and inspections to maintain compliance with safety, health, and environmental regulations;]~~

- (6) The student applies the technical knowledge and skills related to electrical systems in simulated or actual work situations. The student is expected to:
- (A) demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity as defined by Ohm's Law;
 - (B) demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop, current flow, resistance, and ground circuits;
 - (C) use wiring diagrams to trace electrical/electronic circuits;
 - (D) demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits;
 - (E) confirm proper battery capacity for vehicle application and perform battery capacity test;
 - (F) perform battery state-of-charge test;
 - (G) inspect and clean the battery, fill battery cells, and check battery cables, connectors, clamps, and hold-downs;
 - (H) perform starter current draw test;
 - (I) inspect and test fusible links, circuit breakers, fuses, and relays;
 - (J) perform charging system output test;
 - (K) inspect, adjust, or replace generator/alternator drive belts and check pulleys and tensioners for wear and belt alignment;
 - (L) verify operation of instrument panel gauges and warning/indicator lights, and reset maintenance indicators;
 - (M) inspect interior and exterior lamps and sockets, including headlights and auxiliary light such as fog and driving lights and replace as needed; and
 - (N) verify windshield wiper and washer operation and replace wiper blades as needed.
- (7) The student applies the technical knowledge and skills related to heating and air conditioning (A/C) in simulated or actual work situations. The student is expected to:
- (A) identify refrigerant type and the safety and environmental concerns related to handling and storage;
 - (B) inspect engine cooling and heater systems hoses;
 - (C) inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets;
 - (D) inspect A/C condenser for airflow restrictions; and
 - (E) identify hybrid vehicle A/C system electrical circuits and the service/safety precautions.
- (8) The student applies the technical knowledge and skills related to manual and automatic drive train and axles in simulated or actual work situations. The student is expected to:
- (A) identify the different fluid types used in both an automatic and manual transmission/transaxle;
 - (B) identify the fluid types and capacity required by application using service information;
 - (C) check fluid level in a transmission or a transaxle equipped with a dip-stick;
 - (D) check fluid level in a transmission or a transaxle not equipped with a dip-stick;
 - (E) check fluid condition and inspect for leaks;
 - (F) drain and replace fluid and filter or filters in an automatic transmission/transaxle;
 - (G) drain and replace fluid in an manual transmission/transaxle; and

- (H) inspect power train mounts.
- (9) The student applies the technical knowledge and skills related to engine performance in simulated or actual work situations. The student is expected to:
- (A) inspect and explain the electrical/electronic components, sensors and circuits on an on board diagnostics (OBD) controlled engine;
 - (B) perform engine absolute manifold pressure tests such as vacuum or boost;
 - (C) verify engine operating temperature;
 - (D) remove and replace spark plugs and inspect secondary ignition components for wear and damage;
 - (E) describe the importance of operating all OBD II monitors for repair verification;
 - (F) retrieve and record diagnostic trouble codes, OBD II monitor status, and freeze frame data and clear codes when applicable;
 - (G) inspect, service, or replace air filters, filter housings, and intake duct work;
 - (H) replace fuel filter or filters;
 - (I) inspect integrity of the exhaust manifolds, exhaust pipes, mufflers, catalytic converters, resonators, tail pipes, and heat shields; and
 - (J) inspect, test, and service positive crankcase ventilation (PCV) system and its components such as the filter/breather cap, valve, tubes, orifices, and hoses.
- (10) The student applies the technical knowledge and skills related to suspension systems and simulated or actual work situations. The student is expected to:
- (A) identify and interpret tire sidewall data information such as Department of Transportation (DOT) production date information, tire load capacity, inflation pressures, sizing description, and speed rating;
 - (B) demonstrate tire tread depth measuring procedures using industry standards such as common tread depth gauges;
 - (C) demonstrate tire and wheel balance such as static and dynamic balance, and proper wheel weight selection;
 - (D) demonstrate tire and wheel measurements such as radial and lateral run-out in tire and wheel assembly;
 - (E) inspect steering linkage components and mounts such as inner and outer tie-rod ends, pitman arm, idler arm, inner rack and pinion ends, rack and pinion mounts, upper and lower ball joints, power steering pump, and hoses for leaks;
 - (F) remove, clean, inspect, and repack wheel bearings, properly install wheel seals, and adjust wheel bearing pre-load;
 - (G) inspect shock absorbers and McPherson struts for leakage and performance using jounce and rebound tests;
 - (H) demonstrate wheel stud replacement and installation of wheel and tire assembly with proper torqueing procedure;
 - (I) identify and test the Tire Pressure Monitoring Systems (TPMS), both the direct and indirect, for proper operation;
 - (J) dismount and mount a tire on a wheel and reinstall the assembly, including torqueing the lug nuts; and
 - (K) rotate tires according to manufacturer recommendations.

§130.450. [Advanced] Automotive Technology II : Automotive Service (Two Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Automotive Technology I: Maintenance and Light Repair [Automotive Technology I or Automotive Basics H]. Students shall be awarded two credits for successful completion of this course.
- (b) Introduction.
- (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) [Advanced] Automotive Technology II : Automotive Service includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. [Advanced] Automotive Technology II : Automotive Service includes applicable safety and environmental rules and regulations. In this course [Advanced Automotive Technology II], students will gain knowledge and skills in the repair, maintenance, and diagnosis of vehicle systems. This study will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace such as safety glasses and other personal protective equipment (PPE) and safety data sheets (SDS); [-as specified by appropriate governmental regulations;]
 - (B) identify employment opportunities, including entrepreneurship opportunities and internships, and industry-recognized certification requirements for the field of automotive technology;
 - (C) demonstrate the principles of group participation, team concept, and leadership related to citizenship and career preparation;
 - (D) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the automotive technology industry;
 - (E) discuss certification opportunities;
 - (F) discuss response plans to emergency situations;
 - (G) identify employers' expectations and appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and
 - (H) develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities.
 - (D) identify employers' expectations and appropriate work habits;

- ~~[(E) — apply the competencies related to resources, information systems, and technology;]~~
- ~~[(F) — demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace, as specified by appropriate governmental regulations;]~~
- ~~[(G) — discuss ethics in a variety of workplace situations;]~~
- ~~[(H) — prepare a resume; and]~~
- ~~[(I) — demonstrate job interview skills.]~~
- (2) The student relates core academic skills to the requirements of automotive technology. The student is expected to:
- ~~[(A) — demonstrate effective written communication skills throughout the course, including documenting on a repair order customer concern/compliant, root cause of the failure, and corrective action to complete the repair;~~
- ~~[(A) — complete repair orders and related paperwork; and]~~
- ~~(B) — estimate the cost of parts and labor operations [~~eosts~~] on repair orders throughout the course, including the flat rate system; [;]~~
- ~~[(C) — demonstrate mathematical skills in performing addition, subtraction, multiplication, division, and measurements using decimals and fractions in the metric and U.S. standard systems as appropriate; and]~~
- ~~[(D) — research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.]~~
- (3) The student **demonstrates** [~~knows~~] the technical knowledge and skills that form the core of knowledge of automotive service. The student is expected to:
- ~~(A) — diagnose the major components of powered vehicles;~~
- ~~(B) — diagnose automotive chassis and driveline components;~~
- ~~(C) — locate, read, and interpret documents such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair information and technical [~~manuals and~~] bulletins;~~
- ~~[(D) — locate the manufacturer recommended preventative maintenance schedule;~~
- ~~[(E) — perform a preventative maintenance inspection;~~
- ~~[(F) — perform common fastener and thread repair, including removing broken bolt, restoring internal and external threads, and repairing internal threads with thread insert;~~
- ~~[(G) [~~D~~] — perform precision measurements and use published specifications to diagnose component wear and determine necessary repairs; and]~~
- ~~[(H) [~~E~~] — employ critical-thinking skills and structured problem-solving skills to diagnose vehicle malfunctions, solve problems, and make decisions.]~~
- (4) The student knows the functions and applications of the tools, equipment, technologies, and materials used in automotive technology. The student is expected to:
- ~~(A) — demonstrate the proper and safe use of hand and power tools and equipment commonly employed in the maintenance and repair of vehicles;~~
- ~~(B) — discuss and demonstrate the proper handling and disposal of environmentally hazardous materials used in servicing vehicles; [~~and~~]~~
- ~~(C) — demonstrate proper use of diagnostic tools and equipment ; and [;]~~
- ~~[(D) — locate, read, and interpret service repair information such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair bulletins.]~~

- (5) The student applies the technical knowledge and skills related to suspension in simulated or actual work situations. The student is expected to:
- (A) inspect and replace power steering hoses and fittings;
 - (B) remove, clean, inspect, repack, and install wheel bearings; replace seals; install hubs; and adjust bearings;
 - (C) replace wheel bearing and race;
 - (D) disable and enable supplemental restraint system (SRS);
 - (E) inspect, remove, and replace shock absorbers and struts and inspect mounts and bushings;
 - (F) dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system (TPMS);
 - (G) inspect rear suspension system lateral links/arms, trailing arms, leaf springs, spring insulators, shackles, brackets, center pins, and mounting bolts;
 - (H) inspect tire condition and wear patterns, check for correct size and application based on load and speed rating, and adjust air pressure;
 - (I) perform pre-alignment inspection and measure vehicle ride height;
 - (J) inspect tire and wheel assembly for air loss;
 - (K) identify and test indirect and direct TPMSs and operation of the instrument panel lamps;
 - (L) demonstrate knowledge of steps required to remove and replace sensors in a TPMS; and
 - (M) inspect, remove, and replace front wheel drive (FWD) bearings, hubs, seals, shafts, boots, and universal/constant velocity (CV) joints.

~~[(5) The student applies the technical knowledge and skills of the trade to simulated or actual work situations. The student is expected to:]~~

- ~~[(A) perform regular audits and inspections;]~~
- ~~[(B) discuss ordering, stocking, and locating parts;]~~
- ~~[(C) analyze malfunctions and remove, repair, and replace engine components;]~~
- ~~[(D) diagnose, service, and repair steering and suspension systems;]~~
- ~~[(E) test, diagnose, service, and repair automotive electrical and electronic systems;]~~
- ~~[(F) diagnose, service, and repair air conditioning, heating, and accessory systems;]~~
- ~~[(G) diagnose, service, and repair chassis and power train components and systems;]~~
- ~~[(H) test, diagnose, service, and repair air, fuel, ignition, emissions, and drive systems; and]~~
- ~~[(I) test, diagnose, service, and repair cooling and lubrication systems;]~~

(6) The student applies the technical knowledge and skills related to electrical systems in simulated or actual work situations. The student is expected to:

- (A) demonstrate knowledge of the causes and effects from shorts, opens, and resistance in electrical/electronic circuits;
- (B) measure key-off battery drain/parasitic draw;
- (C) perform solder repair of electrical wiring;
- (D) replace electrical connectors and terminal ends;
- (E) demonstrate the ability to maintain or restore electronic memory functions;
- (F) perform slow and fast battery charges according to manufacturer recommendations;

- (G) identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting a vehicle battery;
 - (H) perform starter current draw test and starter circuit voltage drop tests and inspect and test starter relays and solenoids;
 - (I) remove and install starter in a vehicle;
 - (J) inspect and test switches, connectors, and wires of starter control circuits;
 - (K) perform charging system output test;
 - (L) remove, inspect, and re-install alternator;
 - (M) identify system voltage and safety precautions associated with high-intensity discharge headlights;
 - (N) disable and enable airbag system for vehicle service and verify indicator lamp operation;
 - (O) remove and reinstall a door panel; and
 - (P) describe the operation of keyless entry and remote-start systems.
- (7) The student applies the technical knowledge and skills related to brakes in simulated or actual work situations. The student is expected to:
- (A) describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS);
 - (B) measure brake pedal height, reserve distance, travel, and free play;
 - (C) identify components of brake warning light system;
 - (D) bleed and flush brake system;
 - (E) identify and check the operation of brake stop light system; and
 - (F) identify traction control and vehicle stability control system components.
- (8) The student applies the technical knowledge and skills related to engine performance in simulated or actual work situations. The student is expected to:
- (A) describe the importance of operating all on board diagnostics II (OBDII) monitors for repair verification;
 - (B) perform cylinder power balance test;
 - (C) perform cylinder cranking and running compression tests;
 - (D) perform cylinder leakage test;
 - (E) verify engine operating temperature;
 - (F) remove and replace spark plugs and inspect secondary ignition components for wear and damage; and
 - (G) retrieve and record diagnostic trouble codes and OBD II monitor status, freeze frame data, and clear trouble codes when applicable.
- (9) The student applies the technical knowledge and skills related to engines in simulated or actual work situations. The student is expected to:
- (A) install engine covers using gaskets, seals, and sealers as required;
 - (B) remove and replace timing belt and verify correct camshaft timing;
 - (C) perform cooling system pressure and dye tests to identify leaks, check coolant condition and level, and inspect and test radiator, pressure cap, coolant recovery tank, and heater core; and

- (D) remove, inspect, and replace thermostat and gasket or seal.
- (10) The student applies the technical knowledge and skills related to heating ventilation and air conditioning (HVAC) in simulated or actual work situations. The student is expected to:
 - (A) identify, locate, and replace cabin air filters;
 - (B) inspect air conditioning (A/C) condenser for airflow restrictions;
 - (C) identify the source of A/C system odors; and
 - (D) identify hybrid vehicle A/C system electrical circuits and safety precautions.

§130.451. Advanced Transportation Systems Laboratory (One Credit) [~~Automotive Technology II (Three Credits)~~], Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12 as a corequisite course for students participating in a coherent sequence of career and technical education courses in the Transportation, Distribution, and Logistics Career Cluster. This course provides an enhancement opportunity for students to develop the additional skills necessary to pursue industry certification. Recommended prerequisite: a minimum of one credit from the courses in the Transportation, Distribution, and Logistics Career Cluster. Corequisites: Automotive Technology II: Automotive Services, Diesel Equipment Technology II, Collision Repair, Paint and Refinishing, Aircraft Airframe Technology, or Aircraft Powerplant Technology. This course must be taken concurrently with a corequisite course and may not be taken as a stand-alone course. Districts are encouraged to offer this lab in a consecutive block with the corequisite course to allow students sufficient time to master the content of both courses. [~~Prerequisite: Automotive Technology I or Automotive Basics II.~~] Students shall be awarded one credit [~~three credits~~] for successful completion of this course.

(b) Introduction.

- (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
- (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
- (3) Advanced Transportation Systems Laboratory provides the opportunity to extend knowledge of the major transportation systems and the principles of diagnosing and servicing these systems. Topics in this course may include alternative fuels such as hybrid, bio diesel, hydrogen, compressed natural gas (CNG), liquidized natural gas (LNG), propane, and solar; total electric vehicles and power trains; advanced transportation systems such as collision avoidance, telematics, vehicle stability control, navigation, vehicle-to-vehicle communications; and other technologies. This study will allow students to have an increased understanding of science, technology, engineering, and mathematics in all aspects of these systems. This will reinforce, apply, and transfer academic knowledge and skills to a variety of relevant activities, problems, and settings.
- ~~(3) Advanced Automotive Technology II includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. Advanced Automotive Technology II includes applicable safety and environmental rules and regulations. In Advanced Automotive Technology II, students will gain knowledge and skills in the repair, maintenance, and diagnosis of vehicle systems. This study will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.~~
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace such as safety glasses and other personal protective equipment (PPE) and safety data sheets (SDS); [~~as specified by appropriate governmental regulations;~~]

(B) identify employment opportunities, including entrepreneurship opportunities and internships, and industry-recognized certification requirements in [~~for~~] the transportation field of study [~~automotive technology~~];

(C) demonstrate the principles of group participation, team concept, and leadership related to citizenship and career preparation;

[~~D) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the transportation industry;~~

[~~E) discuss certification opportunities;~~

[~~F) discuss response plans to emergency situations;~~

[~~G) identify employers' expectations and appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and~~

[~~H) develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities.~~

[~~D) identify employers' expectations and appropriate work habits;~~

[~~E) apply the competencies related to resources, information systems, and technology;~~

[~~F) demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace, as specified by appropriate governmental regulations;~~

[~~G) discuss ethics in a variety of workplace situations;~~

[~~H) prepare a resume; and~~

[~~I) demonstrate job interview skills.]~~

[~~(2) The student relates core academic skills to the requirements of automotive technology. The student is expected to:~~

[~~(A) complete repair orders and related paperwork; and~~

[~~(B) estimate parts and labor costs on repair orders.]~~

(2) [~~(3)~~] The student demonstrates an understanding of [~~knows~~] the technical knowledge and skills that form the core of knowledge of transportation [~~automotive~~] services. The student is expected to:

(A) extend knowledge of new and emerging transportation technologies related to the corequisite course and its industry such as hybrid, avionics, unmanned aerial systems, collision avoidance, and light duty diesel systems;

(B) demonstrate advanced technical skills related to the corequisite course and its industry;

(C) demonstrate an understanding of the use of advanced tools and equipment; and

(D) demonstrate an understanding of research and development in the transportation industry of the corequisite course.

[~~(A) diagnose and repair the major components of powered vehicles;~~

- ~~[(B) — diagnose and repair automotive chassis and driveline components;]~~
- ~~[(C) — locate, read, and interpret documents such as schematics, charts, diagrams, graphs, parts catalogs, and service repair manuals and bulletins;]~~
- ~~[(D) — perform precision measurements and use published specifications to diagnose component wear and determine necessary repairs;]~~
- ~~[(E) — employ critical thinking skills and structured problem solving skills to diagnose vehicle malfunctions, solve problems, and make decisions; and]~~
- ~~[(F) — discuss alternative fuel vehicles.]~~
- ~~(3) The student develops an elevated aptitude for the essential knowledge and skills listed for the corequisite course. The student is expected to:~~
 - ~~(A) demonstrate deeper understanding of the corequisite course;~~
 - ~~(B) develop hands-on skills at an industry-accepted standard; and~~
 - ~~(C) exhibit progress toward achieving industry-recognized documentation of specific expertise in a transportation field or skill.~~
- ~~[(4) — The student knows the functions and applications of the tools, equipment, technologies, and materials used in automotive technology. The student is expected to:]~~
 - ~~[(A) — demonstrate safe use of hand and power tools and equipment commonly employed in the maintenance and repair of vehicles;]~~
 - ~~[(B) — discuss and demonstrate the proper handling and disposal of environmentally hazardous materials used in servicing vehicles;]~~
 - ~~[(C) — discuss new and emerging automotive technologies; and]~~
 - ~~[(D) — demonstrate proper use of diagnostic tools and equipment.]~~
- ~~[(5) — The student applies the technical knowledge and skills of the trade to simulated or actual work situations. The student is expected to:]~~
 - ~~[(A) — perform regular audits and inspections;]~~
 - ~~[(B) — discuss ordering, stocking, and locating parts;]~~
 - ~~[(C) — analyze malfunctions and remove, repair, and replace engine components;]~~
 - ~~[(D) — diagnose, service, and repair braking, steering, and suspension systems;]~~
 - ~~[(E) — test, diagnose, service, and repair automotive electrical and electronic systems;]~~
 - ~~[(F) — diagnose, service, and repair air conditioning, heating, and accessory systems;]~~
 - ~~[(G) — diagnose, service, and repair chassis and power train components and systems;]~~
 - ~~[(H) — test, diagnose, service, and repair air, fuel, ignition, emissions, and drive systems; and]~~
 - ~~[(I) — test, diagnose, service, and repair cooling and lubrication systems.]~~

§130.452. Introduction to Aircraft Technology (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

- (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
- (3) Introduction to Aircraft Technology is designed to teach the theory of operation of aircraft airframes, ~~powerplants~~ [power plants] , and ~~[avionics systems and~~ associated maintenance and repair practices. Maintenance and repair practices ~~[Aircraft services]~~ include knowledge of the function, diagnosis, and service of general curriculum subjects, airframe structures, airframe systems and components, powerplant theory and maintenance, and powerplant systems and ~~[the electrical, electronic, hydraulic, pneumatic, airframe, mechanical, and power plant]~~ components of aircraft ~~[aircrafts]~~ . Industry recognized professional licensures, certifications, and registrations are available for students who meet the requirements set forth by the accrediting organization.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
- (A) identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of aircraft maintenance and repair ~~[services]~~ ;
- (B) demonstrate the principles of group participation and leadership related to citizenship and career preparation;
- (C) ~~demonstrate~~ [identify] employers' expectations and appropriate work habits;
- (D) discuss the competencies related to resources, information, systems, and technology;
- (E) demonstrate awareness of the technical knowledge and skills related to human factors in health and safety in the workplace, as specified by appropriate governmental regulations and an understanding of personal responsibility in this area ; ~~[and]~~
- (F) ~~demonstrate awareness of the technical knowledge, skills, and attitudes related to human factors in a successful and profitable workplace, and the role of the employee in creating that success, including personal responsibility; and~~
- (G) ~~[(E)]~~ apply reasoning skills to a variety of simulated workplace situations in order to make ethical decisions.
- (2) The student relates academic skills to the requirements of aircraft maintenance and repair ~~[services]~~ . The student is expected to:
- (A) demonstrate effective oral and written communication skills with individuals from various cultures such as fellow workers, management, and customers;
- (B) identify requirements of work orders and related paperwork for repairs;
- ~~[(C) — develop an understanding of how to estimate parts and labor costs on aircraft repair orders;]~~
- (C) ~~[(D)]~~ locate, read, understand the function of, and interpret documents , including ~~[such as]~~ schematics, charts, graphs, drawings, blueprints, wiring diagrams, service-repair manuals and service bulletins, type certificate data sheets, supplemental type certificates, airworthiness directives, and federal aviation regulations and advisory information ;
- (D) ~~[(E)]~~ demonstrate an understanding of metric and U.S. customary standard measurement systems;

- (E) ~~(E)~~ perform precision measurements, including the use of engineering scales, dial calipers, and Vernier micrometers, and use ~~published~~ specifications to diagnose component wear and determine if the component is within tolerance of the specifications ~~necessary repairs~~; and
- (E) ~~(G)~~ develop critical-thinking skills and problem-solving skills to ~~diagnose aircraft system malfunctions,~~ solve problems ~~;~~ and make decisions.
- (3) The student understands the technical knowledge and skills for aircraft maintenance and repair services. The student is expected to:
- (A) demonstrate knowledge of aviation regulations prescribed by the Code of Federal Regulations, Title 14, Volumes I-III, that govern mechanic privileges and the construction, maintenance, and service of aircraft ~~aircrafts~~;
- (B) apply and understand the principles of simple machines, basic aerodynamics, aircraft structures, and theory of flight;
- ~~(B) demonstrate knowledge of aircraft navigation and electronic communication systems;~~
- (C) demonstrate knowledge of aircraft categories as used with respect to the certification, ratings, privileges, and limitations of airmen, including airplane, rotorcraft, glider, and lighter-than-air;
- (D) ~~(C)~~ demonstrate knowledge of airframe construction and basic repair methods and techniques, including wood structures, metal tubular structures, fabric coverings, sheet metal, and composite structures;
- (E) demonstrate knowledge of airframe systems and components, their functions, and basic operating principles, including landing gear, hydraulic power, cabin atmosphere control systems, and electrical systems;
- ~~(D) demonstrate knowledge of aircraft assembly and rigging procedures;~~
- (F) ~~(E)~~ demonstrate knowledge ~~of the service and maintenance~~ of aircraft reciprocating and turbine engines, their operating theory, functions, and basic repair methods and techniques ~~systems, and components~~;
- (G) demonstrate knowledge of powerplant systems and components, their functions, and basic operating principles, including engine instruments, electrical systems, lubrication systems, ignition and starting systems, cooling systems, exhaust systems, and propellers;
- (H) ~~(E)~~ demonstrate knowledge of aircraft common terminology and ~~;~~ standard practices ~~and the tools~~ required to complete maintenance, modifications, and repairs;
- (I) ~~(G)~~ discuss the completion of logbooks and computer applications to maintain required aircraft documents; and
- (J) demonstrate an understanding of the regular audits and inspections to maintain compliance with airworthiness, safety, health, and environmental regulations.
- ~~(H) demonstrate knowledge of wiring diagrams;~~
- (4) The student understands the function and application of the tools, equipment, technologies, and preventative maintenance ~~materials~~ used in aircraft maintenance and repair services. The student is expected to:
- ~~(A) identify materials and processes used in aircraft maintenance;~~
- (A) ~~(B)~~ demonstrate knowledge and basic skills in ~~understanding of how to~~ safely using ~~use~~ hand and power tools and equipment commonly employed in the maintenance and repair of aircraft ~~aircrafts~~;
- (B) ~~(C)~~ demonstrate knowledge of the proper handling and disposal of environmentally hazardous materials used in servicing aircraft ~~aircrafts~~;

- ~~[(D) demonstrate an understanding of the regular audits and inspections to maintain compliance with safety, health, and environmental regulations; and]~~
- ~~(C) [(E)] research and understand the impact of new and emerging aircraft technologies ; and []~~
- ~~(D) identify and understand the need for preventative maintenance procedures and practices.~~
- (5) The student applies the technical knowledge and skills of the trade to simulated situations. The student is expected to:
- ~~[(A) demonstrate knowledge of procedures to accurately calculate aircraft weight and balance;]~~
- ~~(A) start and ground operate an aircraft or simulated aircraft using a high fidelity flight simulator with a physical yoke and pedal device;~~
- ~~[(B) demonstrate knowledge of procedures to predict flight time and fuel consumption;]~~
- ~~[(C) demonstrate knowledge of procedures to predict wind vector, drift, headings, and speed from meteorological information;]~~
- ~~(B) research and locate appropriate documentation to perform a function in a written work order and complete the required logbook entry;~~
- ~~(C) draw top, side, and front views of various aircraft categories, including airplane, rotorcraft, glider, and lighter-than-air;~~
- ~~(D) [explain or] perform basic [required aircraft] airframe [, instrument,] and engine inspections;~~
- ~~(E) construct an engine troubleshooting chart showing simple defects and resulting effects on engine performance; and~~
- ~~[(E) demonstrate knowledge of aircraft hydraulic and landing gear systems and components; and]~~
- ~~(F) discuss preventative maintenance plans and systems to keep aircraft systems in operation.~~
- (6) The student demonstrates appropriate interpersonal and communication skills. The student is expected to:
- ~~(A) describe and apply ethical and legal responsibilities appropriate to the workplace;~~
- ~~(B) demonstrate proper etiquette and behavior;~~
- ~~(C) identify benefits of personal appearance and health habits;~~
- ~~(D) practice written and oral communication skills; and~~
- ~~(E) employ effective listening skills.~~
- (7) The student demonstrates knowledge of and how to develop an occupational experience program as it relates to the aircraft industry. The student is expected to:
- ~~(A) demonstrate knowledge of proper record-keeping skills as related to industry-based occupational experiences;~~
- ~~(B) participate in youth leadership opportunities to create a well-rounded occupational experience;~~
- ~~(C) produce a program of activities for a career and technical student organization or other leadership opportunity; and~~
- ~~(D) develop a work plan and budget.~~

§130.453. Aircraft Airframe Technology ~~[I]~~ (Two Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Introduction to Aircraft Technology. Students shall be awarded two credits for successful completion of this course.
- (b) Introduction.
- (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Aircraft Airframe Technology ~~[I]~~ is designed to teach the theory of operation of aircraft airframes ~~[, power plants, and avionics systems]~~ and associated maintenance and repair practices. Airframe maintenance and repair practices ~~[Aircraft services]~~ include knowledge of the function, diagnosis, and service of airframe structures, systems, and ~~[the electrical, electronic, hydraulic, pneumatic, airframe, mechanical, and power plant]~~ components of aircraft ~~[aircrafts]~~ .
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of aircraft maintenance and repair ~~[services]~~ ;
 - (B) demonstrate the principles of group participation and leadership related to citizenship and career preparation;
 - (C) evaluate ~~[identify]~~ employers' expectations and appropriate work habits;
 - (D) discuss the competencies related to resources, information systems, and technology;
 - (E) demonstrate awareness ~~[knowledge]~~ of the technical knowledge and skills related to human factors in health and safety in the workplace, as specified by appropriate governmental regulations and an understanding of personal responsibility in this area ; ~~[and]~~
 - (F) demonstrate awareness of the technical knowledge, skills, and attitudes related to human factors in a successful and profitable workplace and the role of the employee in creating that success, including personal responsibility; and
 - (G) ~~[(F)]~~ apply reasoning skills to a variety of simulated workplace situations in order to make ethical decisions.
 - (2) The student relates academic skills to the requirements of aircraft maintenance and repair ~~[services]~~ . The student is expected to:
 - (A) demonstrate effective oral and written communication skills with individuals from various cultures such as fellow workers, management, and customers;
 - (B) identify requirements of ~~[complete]~~ work orders and related paperwork for repairs ;
 - (C) develop an understanding of how to estimate parts and labor costs on airframe ~~[for aircraft]~~ repair orders;

- (D) ~~locate, read, understand the function of, and interpret documents, including [such as] schematics, charts, graphs, drawings, blueprints, wiring diagrams, service-repair manuals and service bulletins, type certificate data sheets, supplemental type certificates, airworthiness directives, and federal aviation regulations and advisory information ;~~
- (E) ~~demonstrate an understanding of metric and U.S. customary standard measurement systems;~~
- (F) ~~perform precision measurements, including the use of engineering scales, dial calipers, and Vernier micrometers [and use published specifications to diagnose component wear and determine necessary repairs] ; and~~
- (G) ~~employ critical-thinking skills and structured problem-solving skills to diagnose airframe [aircraft] system malfunctions, solve problems, and make decisions.~~
- (3) The student knows the technical knowledge and skills of aircraft services. The student is expected to:
- (A) ~~demonstrate knowledge of aviation regulations prescribed by the Code of Federal Regulations, Title 14, Volumes I-III, that govern mechanic privileges, the construction, maintenance, and service of aircraft, and 100-hour and annual inspections [aircrafts] ;~~
- (B) ~~demonstrate knowledge of aircraft categories as used with respect to the certification of aircraft based upon intended use or operating limitations such as transport, normal, utility, acrobatic, limited, restricted, and provisional;~~
- (C) ~~apply the principles of basic aerodynamics, theory of flight, and the function of primary and secondary flight controls;~~
- (D) ~~demonstrate knowledge of aircraft weight and balance and how repairs, alterations, and loading can adversely affect safe operation of an aircraft;~~
- (E) ~~demonstrate knowledge of aircraft finishes and corrosion prevention and removal processes [aircraft navigation and electronic communication systems] ;~~
- (F) ~~demonstrate knowledge of airframe construction and detailed repair methods and techniques, including wood structures, metal tubular structures, fabric coverings, sheet metal, and composite structures ;~~
- (G) ~~demonstrate knowledge of aircraft assembly and rigging procedures such as structure alignment checks, balancing flight control surfaces, removing and installing flight control surfaces, and jacking aircraft ;~~
- ~~[E] demonstrate knowledge of the service and maintenance of aircraft engines, systems, and components;~~
- (H) ~~demonstrate knowledge of airframe systems and components, their functions, and detailed operating principles, including landing gear, hydraulic power, cabin atmosphere control systems, aircraft instrument systems, aircraft navigation and electronic communication systems, ice and rain control systems, fire protection systems, and electrical systems;~~
- (I) ~~demonstrate knowledge of aircraft common terminology and [] standard practices [, and the proper use of tools] required to complete maintenance, modifications, and repairs; and~~
- (J) ~~discuss the completion of logbooks and computer applications to maintain required aircraft documents ; [and]~~
- ~~[H] demonstrate knowledge of wiring diagrams.]~~
- (4) The student knows the function and application of the tools, equipment, technologies, and preventative maintenance [materials] used in airframe maintenance and repair [aircraft services] . The student is expected to:

- ~~[(A) — identify and select materials and processes used in aircraft maintenance;]~~
- (A) ~~[(B)]~~ demonstrate knowledge and a high degree of skills in safely using ~~[use]~~ hand and power tools and equipment commonly employed in the maintenance and repair of aircraft ~~[aircrafts]~~ ;
- (B) ~~[(C)]~~ demonstrate knowledge of ~~[discuss]~~ the proper handling and disposal of environmentally hazardous materials used in servicing aircraft ~~[aircrafts]~~ ;
- ~~[(D) — perform regular audits and inspections to maintain compliance with safety, health, and environmental regulations; and]~~
- (C) ~~[(E)]~~ research and understand the impact ~~[demonstrate knowledge]~~ of new and emerging aircraft technologies ; and [;]
- ~~[(D) — identify and understand the need for preventative maintenance procedures and practices.]~~
- (5) The student applies the technical knowledge and skills of the trade to simulated and actual work situations. The student is expected to:
- (A) accurately calculate aircraft weight and balance;
- (B) accurately determine airframe component wear by using precision measuring and published specifications to determine if a given component is within wear tolerance and research necessary repairs;
- (C) build and fly a paper airplane with simple flight control surfaces that will predictably complete an objective;
- (D) research proper repair methods for a simulated repair and write a work order that calls out specific maintenance references and estimates cost of repairs;
- (E) create an appropriate inspection checklist for a given airframe based on regulated mandatory inspection points for an annual inspection and perform the inspection;
- (F) fabricate an example or simulated example of an airframe construction and repair method such as wood structures, metal tubular structures, fabric coverings, sheet metal, or composite structures;
- (G) describe the detailed function and operation of an airframe system using drawings and written descriptions;
- (H) construct an airframe system troubleshooting chart showing possible defects and resulting effects on system performance;
- ~~[(B) — predict flight time and fuel consumption;]~~
- ~~[(C) — predict wind vector, drift, headings, and speed from meteorological information;]~~
- ~~[(D) — perform required aircraft airframe, instrument, and engine inspections;]~~
- ~~[(E) — demonstrate knowledge of aircraft hydraulic and landing gear systems and components;]~~
- (I) ~~[(F)]~~ apply the essential knowledge and skills in aircraft maintenance and repair ~~[services]~~ to work-based learning experiences such as cooperative education, job shadowing, mentoring, and apprenticeship training; ~~[and]~~
- (J) ~~[(G)]~~ indicate and select proper products used in ~~[discuss]~~ preventative maintenance for a given aircraft from appropriate maintenance publications; and ~~[plans and systems to keep aircraft systems in operation.]~~
- (K) perform regular audits and inspections to maintain compliance with safety, health, and environmental regulations.
- (6) The student demonstrates appropriate interpersonal and communication skills. The student is expected to:

- (A) describe and apply ethical and legal responsibilities appropriate to the workplace;
 - (B) demonstrate the uses of proper etiquette and behavior;
 - (C) identify benefits of personal appearance and health habits;
 - (D) practice written and oral communication skills; and
 - (E) employ effective listening skills.
- (7) The student learns the value of and how to develop an occupational experience program as it relates to the aircraft industry. The student is expected to:
- (A) apply proper record-keeping skills as related to industry-based occupational experiences;
 - (B) participate in youth leadership opportunities to create a well-rounded occupational experience;
 - (C) produce a program of activities for a career and technical student organization or other leadership opportunity; and
 - (D) develop a work plan and budget.

§130.454. Aircraft Powerplant Technology [H] (Two Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Introduction to Aircraft Technology. Recommended prerequisite: Aircraft Technology I. Students shall be awarded two credits for successful completion of this course.
- (b) Introduction.
- (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Aircraft Powerplant Technology [H] is designed to teach the theory of operation of aircraft powerplants [~~airframes, power plants, and avionics systems~~] and associated maintenance and repair practices. Powerplant maintenance and repair practices [~~Aircraft services~~] include knowledge of the theory, function, diagnosis, and service of powerplant, systems, and components [the electrical, electronic, hydraulic, pneumatic, airframe, mechanical, and power plant components] of aircraft [aircrafts] . Industry-recognized professional licensures, certifications, and registrations are available for students who meet the requirements set forth by the accrediting organization.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) discuss employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of aircraft ~~maintenance and repair~~ [~~services~~];
 - (B) demonstrate the principles of group participation and leadership related to citizenship and career preparation;

- (C) evaluate employers' expectations and appropriate work habits;
 - (D) discuss [apply] the competencies related to resources, information systems, and technology;
 - (E) demonstrate knowledge of the technology and skills related to human factors in health and safety in the workplace, as specified by appropriate governmental regulations and an understanding of personal responsibility in this area ; ~~[and]~~
 - (F) demonstrate awareness of the technical knowledge, skills, and attitudes related to human factors in a successful and profitable workplace, and the role of the employee in creating that success, including personal responsibility; and
 - (G) ~~[(E)]~~ apply reasoning to a variety of workplace situations in order to make ethical decisions.
- (2) The student relates academic skills to the requirements of aircraft maintenance and repair [services] . The student is expected to:
- (A) demonstrate effective oral and written communication skills with individuals from various cultures, including fellow workers, management, and customers;
 - (B) follow ~~[access]~~ work orders and related paperwork;
 - (C) develop an understanding of how to estimate parts and labor costs on powerplant repair orders;
 - ~~[(C)]~~ estimate parts and labor costs for aircraft repair orders;
 - (D) locate, read, understand the function of, and interpret documents , including ~~[such as]~~ schematics, charts, graphs, drawings, blueprints, wiring diagrams, service-repair manuals and service bulletins, type certificate data sheets, supplemental type certificates, airworthiness directives, and federal aviation regulations and advisory information ;
 - (E) demonstrate an understanding of metric and U.S. customary standard measurement systems;
 - (F) ~~[(E)]~~ perform precision measurements , including the use of engineering scales, dial calipers, and Vernier micrometers ~~[and use published specifications to diagnose component wear and determine correct replacement parts]~~ ; and
 - (G) ~~[(E)]~~ employ critical-thinking skills and structured problem-solving skills to diagnose powerplant [aircraft] system malfunctions, solve problems, and make decisions.
- (3) The student knows the technical knowledge and skills of aircraft maintenance and repair [services] . The student is expected to:
- (A) demonstrate knowledge of ~~[research]~~ aviation regulations prescribed by the Code of Federal Regulations, Title 14, Volumes I-III, that govern mechanic privileges, the construction, maintenance, and service of aircraft, and 100-hour and annual inspections [aircraft] ;
 - (B) apply and understand the principles of simple machines, fluid dynamics, and heat dynamics, including Boyle's Law and Charles' Law;
 - (C) demonstrate understanding of aircraft reciprocating engines, including the operating theory, cylinder configurations, functions, and service and repair methods and techniques for two-cycle, four-cycle, and diesel engines;
 - (D) demonstrate understanding of aircraft turbine engines, including the operating theory, mechanical arrangements, functions, and service and repair methods and techniques for turbojet, turbofan, turboprop, and turboshaft engines;
 - (E) demonstrate knowledge of powerplant systems and components, their functions, and basic operating principles, including engine instruments, fire protection systems, electrical systems, lubrication systems, ignition and starting systems, fuel metering

systems, fuel delivery systems, inductions systems, cooling systems, exhaust systems, and propellers;

- (F) review the necessary steps to perform a reciprocating engine overhaul following industry best practices;
- (G) identify and select appropriate nondestructive testing methods for component inspections, including dye penetrant, eddy current, ultrasonic, and magnetic particle inspections;
- (H) demonstrate knowledge of aircraft common terminology and standard practices and the tools required to complete maintenance, modifications, and repairs; and
- (I) discuss the completion of logbooks and computer applications to maintain required aircraft documents.

~~[(B) — diagnose and repair aircraft navigation and electronic communication systems;]~~

~~[(C) — demonstrate airframe construction and repair methods and techniques;]~~

~~[(D) — demonstrate aircraft assembly and rigging procedures; and]~~

~~[(E) — demonstrate service and maintenance of aircraft engines, systems, and components.]~~

- (4) The student knows the function and application of the tools, equipment, technologies, and preventative maintenance [materials] used in airframe maintenance and repair [aircraft services] . The student is expected to:

~~[(A) — identify and select basic materials and processes used in aircraft maintenance;]~~

(A) ~~[(B)] demonstrate knowledge and a high degree of skills in safely using [use] hand and power tools and equipment commonly employed in the maintenance and repair of aircraft [aircrafts] ;~~

(B) ~~[(C)] demonstrate knowledge of [discuss] the proper handling and disposal of environmentally hazardous materials used in maintaining and servicing aircraft; [aircrafts; and]~~

(C) research and understand the impact of new and emerging aircraft technologies; and

(D) identify and understand the need for preventative maintenance procedures and practices.

~~[(D) — demonstrate the application of new and emerging aircraft technologies.]~~

- (5) The student applies the technical knowledge and skills of the trade to simulated and actual work situations. The student is expected to:

(A) determine powerplant component wear accurately by using precision measuring and published specifications to determine if a given component is within wear tolerance and research necessary repairs;

(B) research proper repair methods for a simulated repair and write a work order that calls out specific maintenance references and estimates cost of repairs;

(C) create an appropriate inspection checklist for a given powerplant based on regulated mandatory inspection points for an annual inspection and perform the inspection;

(D) describe the detailed function and operation of a reciprocating and a turbine aircraft powerplant using drawings and written descriptions;

(E) describe the detailed function and operation of a reciprocating or turbine aircraft powerplant system or component using drawings and written descriptions;

(F) construct a detailed engine troubleshooting chart showing possible defects and resulting effects on engine performance of a reciprocating or turbine aircraft powerplant;

~~[(A) — accurately calculate aircraft weight and balance;]~~

~~[(B) — predict flight time and fuel consumption;]~~

- ~~[(C) — predict wind vector, drift, headings, and speed from meteorological information;]~~
 - ~~[(D) — perform required aircraft airframe, instrument, and engine inspections;]~~
 - ~~[(E) — service and repair aircraft hydraulic and landing gear systems and components;]~~
 - ~~[(G) [(F)] apply aircraft maintenance and repair [services] essential knowledge and skills to learning experiences such as job shadowing, mentoring, apprenticeship training, and career preparation;~~
 - ~~[(H) [(G)] indicate and select proper products used in [develop] preventative maintenance for a given powerplant from appropriate maintenance publications [plans and systems to keep aircraft systems in operation] ; and~~
 - ~~[(I) [(H)] perform regular audits and inspections to maintain compliance with safety, health, and environmental regulations.~~
- ~~(6) The student demonstrates appropriate interpersonal and communication skills. The student is expected to:~~
- ~~(A) describe and apply ethical and legal responsibilities appropriate to the workplace;~~
 - ~~(B) demonstrate the uses of proper etiquette and behavior;~~
 - ~~(C) identify benefits of personal appearance and health habits;~~
 - ~~(D) practice written and oral communication skills; and~~
 - ~~(E) employ effective listening skills.~~
- ~~(7) The student learns the value of and how to develop an occupational experience program as it relates to the aircraft industry. The student is expected to:~~
- ~~(A) apply proper record-keeping skills as related to industry-based occupational experiences;~~
 - ~~(B) participate in youth leadership opportunities to create a well-rounded occupational experience;~~
 - ~~(C) produce a program of activities for a career and technical student organization or other leadership opportunity; and~~
 - ~~(D) develop a work plan and budget.~~

§130.455. Basic Collision Repair and Refinishing (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Basic Collision Repair and Refinishing includes knowledge of the processes, technologies, and materials used in the reconstruction [and alteration] of vehicles. This course is designed to teach the concepts and theory of systems related to automotive collision repair and refinishing.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
- (A) demonstrate awareness of workplace safety and environmental responsibilities in automotive collision and refinishing and understand the use of personal protective equipment;
 - (B) identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the fields of collision repair and refinishing;
 - (C) review the principles of group participation and leadership related to citizenship and career preparation;
 - (D) identify employers' expectations and appropriate work habits;
 - (E) review the competencies related to resources, information systems, and technology; and
 - (F) apply reasoning skills to a variety of workplace situations in order to make ethical decisions.
- (2) The student relates core academic skills to the requirements of collision repair and refinishing technology. The student is expected to:
- (A) apply ~~[demonstrate awareness of]~~ effective oral and written communication skills with individuals from various cultures such as fellow workers, management, and customers;
 - ~~(B) use technical writing skills to complete collision repair and refinishing orders and related paperwork; and~~
 - ~~[(B) complete collision repair and refinishing orders and related paperwork;]~~
 - (C) locate and read documents such as ~~service and repair information, technical bulletins, specifications, schematics, and~~ parts catalogs.
 - ~~[(D) demonstrate basic competencies required to use and interpret service repair manuals.]~~
- (3) The student understands the technical knowledge and skills of basic collision repair and refinishing systems. The student is expected to:
- (A) demonstrate ~~an understanding~~ ~~[awareness]~~ of basic types of repair procedures used in the auto collision industry;
 - (B) demonstrate ~~an understanding~~ ~~[awareness]~~ of basic preparation, application, and refinishing ~~with~~ ~~[of]~~ various paint products; ~~and~~
 - (C) estimate parts and labor costs on collision repair and refinishing orders ; ~~[:and]~~
 - ~~[(D) review precision measurement diagrams to diagnose vehicle body shape and frame alignment angles.]~~
- (4) The student knows the basic function and application of tools, equipment, technologies, and materials used in collision repair and refinishing services. The student is expected to:
- (A) identify hand and power tools and equipment commonly ~~used~~ ~~[employed]~~ in collision repair and refinishing;
 - (B) identify proper welding and cutting techniques and processes ~~used in collision repair~~ ;
 - (C) identify environmentally hazardous materials ~~and appropriate handling methods~~ used in collision repair and refinishing technologies; and

- (D) demonstrate awareness of new and emerging collision repair and refinishing technologies.
- (5) The student reviews the technical knowledge and skills of collision repair and refinishing. The student is expected to:
- (A) demonstrate the safe use of various hand and power tools and equipment commonly used in collision repair and refinishing;
- ~~[(A) — review regular audits and inspections to maintain compliance with safety, health, and environmental regulations;]~~
- (B) identify types of vehicle construction materials and associated repair methods;
- ~~(C) — remove paint from the damaged area of a body panel;~~
- ~~(D) — identify and repair surface irregularities on a damaged body panel;~~
- ~~(E) — demonstrate hammer and dolly techniques for dent repair;~~
- ~~(F) — prepare damaged area using water-based and solvent-based cleaners;~~
- ~~(G) — identify, prepare, and apply body filler;~~
- ~~(H) — rough sand body filler to contour panel and finish sand for the application of primer;~~
- ~~(I) — demonstrate the proper preparation, application, and refinishing of various paint products;~~
- ~~(J) — apply finish using appropriate spray techniques such as gun arc, angle, distance, travel speed, and spray pattern overlap for the finish being applied;~~
- ~~(K) — apply basecoat and clear coat for overall refinishing; and~~
- ~~(L) — sand, buff, and polish fresh or existing finish to remove defects as required.~~
- ~~[(C) — identify methods of collision energy management and types of damage;]~~
- ~~[(D) — determine vehicle damage and prepare an estimate of the repair costs;]~~
- ~~[(E) — determine body panel damage and identify the associated repair methods;]~~
- ~~[(F) — identify types of vehicle finishes and associated refinish techniques;]~~
- ~~[(G) — identify vehicle occupant restraint systems and associated repair methods;]~~
- ~~[(H) — identify vehicle body components and repair or replace considerations;]~~
- ~~[(I) — review the welding and cutting processes used in vehicle collision repair;]~~
- ~~[(J) — review mechanical and electrical components;]~~
- ~~[(K) — identify and determine the cause of paint and refinishing defects;]~~
- ~~[(L) — discuss interior and exterior trim repair;]~~
- ~~[(M) — discuss corrosion protection; and]~~
- ~~[(N) — review vehicle detailing;]~~

§130.456. Collision Repair [~~and Refinishing I~~] (Two Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 10-12. **Recommended prerequisite:** [~~Prerequisite:~~] Basic Collision Repair and Refinishing. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

- (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
- (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
- (3) Collision Repair [~~and Refinishing I~~] includes knowledge of the processes, technologies, and materials used in the reconstruction [~~and alteration~~] of vehicles. This course is designed to teach the concepts and theory of systems related to automotive collision repair and refinishing.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) demonstrate ~~an understanding~~ [~~awareness~~] of workplace safety and environmental responsibilities regarding automotive collision ~~repair~~ [~~and refinishing~~] and understand the use of personal protective equipment;
 - (B) identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the fields of collision repair [~~and refinishing~~];
 - (C) demonstrate the principles of group participation and leadership related to citizenship and career preparation;
 - (D) identify employers' expectations and appropriate work habits;
 - (E) review the competencies related to resources, information systems, and technology; and
 - (F) apply reasoning skills to a variety of workplace situations in order to make ethical decisions.
- (2) The student relates core academic skills to the requirements of collision repair [~~and refinishing technology~~]. The student is expected to:
 - (A) apply [~~demonstrate~~] effective oral and written communication skills with individuals from various cultures such as fellow workers, management, and customers;
 - (B) use technical writing skills to complete collision repair [~~and refinishing~~] orders and related paperwork;
 - (C) locate, read, and interpret documents such as ~~service and repair information, technical bulletins, specifications, schematics, and~~ [~~charts, diagrams, graphs,~~] parts catalogs [~~and service repair manuals and bulletins~~]; and
 - (D) apply mathematical skills to the estimating process such as ~~establishing charges and totals, profit margins, technician productivity, and shop efficiency.~~
 - ~~(D) demonstrate competencies required to use and interpret service repair manuals.~~
- (3) The student understands the technical knowledge and skills of collision repair [~~and refinishing systems~~]. The student is expected to:
 - (A) demonstrate ~~an understanding of~~ [~~the~~] basic types of repair procedures for the different types of vehicle body construction used in the auto collision industry;

- (B) demonstrate an understanding of pre-repair and repair inspection of non-damaged components;
 - (C) ~~(B)~~ demonstrate the proper preparation, application, and refinishing of various paint products;
 - (D) ~~(C)~~ estimate parts and labor costs of ~~(on)~~ collision repair ~~[and refinishing orders]~~ ;
and
 - (E) ~~(D)~~ perform precision measurements ~~[using mechanical devices]~~ to diagnose vehicle body shape and frame alignment angles.
- (4) The student knows the function and application of tools, equipment, technologies, and materials used in collision repair ~~[and refinishing services]~~ . The student is expected to:
- (A) use hand and power tools and equipment commonly employed in collision repair ~~[and refinishing]~~ , according to industry safety standards;
 - (B) identify proper welding and cutting techniques and processes ~~in collision repair]~~ ;
 - (C) properly handle and dispose of environmentally hazardous materials used in collision repair and refinishing technologies; and
 - (D) demonstrate knowledge of new and emerging collision repair ~~[and refinishing technologies]~~ .
- (5) The student applies the technical knowledge and skills of collision repair and refinishing to simulated or actual work situations. The student is expected to:
- (A) perform regular audits and inspections to maintain compliance with safety, health, and environmental regulations;
 - (B) identify types of vehicle construction materials and associated repair methods;
 - (C) identify methods of collision energy management and types of damage;
 - (D) determine vehicle damage and prepare an estimate of the repair costs;
 - (E) determine body panel damage and identify the associated repair methods ~~, including inspection, disassembly, and repair or replacement of components]~~ ;
 - (F) ~~inspect, remove, replace, and align various body components such as hoods, hinges, latches, and bumper covers;~~
 - (G) ~~(F)~~ identify types of vehicle finishes and associated refinish techniques;
 - (H) ~~inspect, remove, and replace bolted, bonded, and welded panels or panel assemblies;~~
 - (I) ~~(G)~~ identify vehicle occupant restraint systems and associated repair methods;
 - (J) ~~(H)~~ identify vehicle body components and ~~assess for~~ repair or replacement ~~[considerations]~~ ;
 - (K) ~~(I)~~ demonstrate the welding and cutting processes used in vehicle collision repair;
 - (L) ~~(J)~~ remove, install, and adjust vehicle mechanical ~~systems~~ and electrical components;
 - (M) ~~(K)~~ identify and determine the cause of paint and refinishing defects;
 - (N) ~~(L)~~ discuss interior and exterior trim repair;
 - (O) ~~(M)~~ discuss corrosion protection ~~, including sealers, adhesives, and under-coatings]~~ ;
~~[and]~~
 - (P) ~~prepare damaged area using water-based and solvent-based cleaners;~~
 - (Q) ~~(N)~~ demonstrate vehicle detailing ; ~~]~~
 - (R) ~~restore sound deadeners and foam materials; and~~
 - (S) ~~diagnose and repair water leaks, dust leaks, and wind noise.~~

- (6) The student applies the technical knowledge and skills of metal finishing and body filling to simulated or actual work situations. The student is expected to:
- (A) remove paint from damaged area of a body panel;
 - (B) identify and repair surface irregularities on a damaged body panel;
 - (C) demonstrate hammer and dolly techniques for dent repair;
 - (D) heat shrink stretched panel areas to proper contour;
 - (E) cold shrink stretched panel areas to proper contour;
 - (F) identify, prepare, and apply body filler;
 - (G) rough sand body filler to contour panel and finish sand for the application of primer;
 - (H) determine the proper metal finishing techniques for aluminum; and
 - (I) determine the proper application of body filler to aluminum.
- (7) The student applies the technical knowledge and skills of moveable glass and hardware to simulated or actual work situations. The student is expected to:
- (A) inspect, adjust, repair, or replace window systems such as regulators, run channels, glass, power mechanisms, and related controls;
 - (B) inspect, adjust, remove, repair, or reinstall body sealing systems such as weather stripping;
 - (C) inspect, adjust, repair, or replace regulators, run channels, glass, power mechanisms, and related controls for roof panel options such as sun roofs and convertible tops; and
 - (D) inspect, remove, reinstall, and align convertible tops and related mechanisms.
- (8) The student applies the technical knowledge and skills of plastics and adhesives to simulated or actual work situations. The student is expected to:
- (A) identify the types of plastics used in automotive applications;
 - (B) clean and prepare the surface of plastic parts;
 - (C) repair rigid, semi-rigid, or flexible plastic panels;
 - (D) remove or repair damaged areas from rigid exterior composite panels; and
 - (E) replace bonded rigid exterior composite body panels, including straightening or aligning panel supports.
- (9) The student applies the technical knowledge and skills of damage analysis to simulated or actual work situations. The student is expected to:
- (A) prepare vehicle for inspection by providing access to damaged areas;
 - (B) analyze damage to determine appropriate methods for overall repairs;
 - (C) perform visual inspection of structural components and members;
 - (D) identify structural damage using measuring tools and equipment;
 - (E) perform visual inspection of non-structural components and members;
 - (F) determine parts, components, material type(s), and procedures necessary for a proper repair;
 - (G) identify type and condition of finish and determine if refinishing is required;
 - (H) identify suspension, electrical, and mechanical component physical damage;
 - (I) identify safety systems physical damage;

- (J) identify interior component damage;
- (K) identify damage to add-on accessories and modifications; and
- (L) identify single/one-time use components.
- (10) The student applies the technical knowledge and skills of estimating in simulated or actual work situations. The student is expected to:
 - (A) locate and record customer/vehicle owner information;
 - (B) locate and record vehicle identification number (VIN) information, including nation of origin, make, model, restraint system, body type, production date, engine type, and assembly plant;
 - (C) identify and record vehicle options, including trim level, paint code, accessories, and modifications;
 - (D) identify the safety systems;
 - (E) apply appropriate estimating and parts terminology;
 - (F) determine and apply appropriate estimating sequence;
 - (G) utilize estimating guide procedure pages;
 - (H) estimate labor time for operations;
 - (I) select appropriate labor rates for each operation such as structural, non-structural, mechanical, and refinish;
 - (J) select and price replacement parts such as original equipment manufacturer (OEM), alternative/optional OEM, aftermarket, recycled/used, remanufactured, rebuilt, and reconditioned parts;
 - (K) determine labor time, prices, charges, allowances, or fees for non-included operations and miscellaneous items;
 - (L) determine additional material and charges such as environmental, administrative, shop, and disposal fees;
 - (M) determine refinishing material and charges;
 - (N) review computer-assisted and manually written estimates and verify that the information is correct;
 - (O) identify labor time and material charges for restoring corrosion protection; and
 - (P) determine the approximate vehicle retail value compared to the repair cost.

§130.457. Paint [~~Collision Repair~~] and Refinishing [H] (~~Two~~ [~~Three~~] Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: [~~Prerequisite:~~] Basic Collision Repair and Refinishing or Collision Repair [~~and Refinishing I~~]. Students shall be awarded ~~two~~ [~~three~~] credits for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

- (3) Paint [~~Collision Repair~~] and Refinishing [H] includes knowledge of the processes, technologies, and materials used in the reconstruction [~~and alteration~~] of vehicles. This course is designed to teach the concepts and theory of systems related to automotive paint [~~collision repair~~] and refinishing.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
- (A) demonstrate awareness [~~advanced knowledge~~] of workplace safety and environmental responsibilities in automotive paint [~~collision~~] and refinishing and understand the use of personal protective equipment;
- ~~[(B) — use oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information;]~~
- (B) ~~[(C)]~~ identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field [~~fields~~] of automotive paint [~~collision repair~~] and refinishing;
- ~~[(D) — solve problems using creativity, innovation, and critical thinking skills, including analyzing, synthesizing and evaluating independently and in teams;]~~
- (C) ~~[(E)]~~ demonstrate [~~examine~~] the principles of group participation and leadership related to citizenship and career preparation;
- (D) identify employers' expectations and appropriate work habits;
- (E) review the competencies related to resources, information systems, and technology; and
- (F) apply reasoning skills to a variety of workplace situations in order to make ethical decisions.
- ~~[(F) — clarify the problems or issues to be addressed in collision repair;]~~
- ~~[(G) — identify constraints and parameters related to the problems presented in a collision shop;]~~
- ~~[(H) — formulate a set of objectives for the solution that address the key issues presented in a collision shop;]~~
- ~~[(I) — prepare a resume; and]~~
- ~~[(J) — demonstrate job interview skills;]~~
- (2) The student relates core academic skills to the requirements of paint [~~collision repair~~] and refinishing. The student is expected to:
- (A) demonstrate effective oral and written communication skills [~~evaluate possible outcomes from implementation of alternative solutions~~] with individuals from various cultures such as fellow workers, management, and customers;
- (B) use technical writing skills to [~~analyze available information and evaluate and~~] complete paint [~~collision repair~~] and refinishing orders and related paperwork;
- (C) locate, read, and [~~synthesize various ideas and proposals to~~] interpret documents such as service and repair information, technical bulletins, specifications, schematics, and [~~charts, diagrams, graphs,~~] parts catalogs [~~, and service repair manuals and bulletins~~]; and

- (D) demonstrate competencies required to use and interpret [evaluate the accuracy of the basic assumptions outlined in] service repair bulletins [manuals] .
- (3) The student understands the technical knowledge and skills of paint and refinishing systems. The student is expected to:
- ~~[(3) The student develops, implements, and evaluates solutions to collision repair related performance problems using a structured problem solving process in order to improve business. The student is expected to:]~~
- (A) demonstrate the basic types of refinishing [develop and represent comprehensive repair] procedures for the different types of vehicle body construction used in the auto refinishing [collision] industry;
- (B) demonstrate [access] the proper preparation, application, and refinishing with [of] various paint products, decals, and adhesives;
- (C) estimate parts and labor costs on paint [assess the potential impact of the risks, costs, and benefits of collision repair] and refinishing orders; and
- (D) perform precision measurements of paint and materials. [using mechanical devices and use published specifications to diagnose problems and determine necessary repairs.]
- (4) The student knows the function and application of tools, equipment, technologies, and materials used in paint [collision repair] and refinishing services. The student is expected to:
- (A) identify safety and personal health hazards according to Occupational Safety and Health Association (OSHA) guidelines and the "Right to Know Law";
- (B) inspect spray environment and equipment to ensure compliance with federal, state, and local regulations and for safety and cleanliness hazards;
- (C) select, use, inspect, ensure fit and operation, and perform maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulation of a National Institute of Occupational of Safety and Health (NIOSH) approved air purifying respirator;
- (D) select, use, and perform maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulation for a NIOSH approved fresh air make-up respirator system;
- (E) select and use the proper personal safety equipment such as gloves, suits, hoods, and eye and ear protection;
- (F) ~~[(A)]~~ use hand and power tools and equipment commonly employed in paint [collision repair] and refinishing technologies, according to industry safety standards;
- ~~[(B) demonstrate proper welding and cutting techniques and processes;]~~
- (G) ~~[(G)]~~ properly handle and dispose of environmentally hazardous materials used in paint [collision repair] and refinishing technologies; and
- (H) ~~[(D)]~~ [discuss and] demonstrate knowledge of new and emerging paint [collision repair] and refinishing technologies.
- (5) The student applies the technical knowledge and skills of paint [collision repair] and refinishing to simulated or actual work situations. The student is expected to:
- (A) perform [and analyze] regular audits and inspections to maintain compliance with safety, health, and environmental regulations;
- (B) inspect types of vehicle construction materials and associated refinishing [repair] methods;
- ~~[(C) inspect methods of collision energy management and types of damage;]~~

- ~~[(D) — inspect for vehicle damage and prepare an estimate of the repair costs;]~~
 - ~~[(E) — inspect and determine body panel damage and identify the associated repair methods;]~~
 - (C) [(F)] identify [inspect] different types of vehicle finishes and associated refinish techniques;
 - ~~[(G) — inspect vehicle occupant restraint systems and associated repair methods;]~~
 - ~~[(H) — inspect vehicle body components and repair or replace considerations;]~~
 - ~~[(I) — demonstrate the welding and cutting processes used in vehicle collision repair;]~~
 - ~~[(J) — remove, install, and adjust vehicle mechanical and electrical components;]~~
 - (D) [(K)] inspect, identify, and determine the cause of paint and refinishing defects;
 - ~~[(L) — discuss and demonstrate interior and exterior trim repair;]~~
 - (E) [(M)] discuss [and demonstrate] corrosion protection; and
 - (F) [(N)] demonstrate [and discuss] vehicle detailing.
- (6) The student applies the technical knowledge and skills of surface preparation to simulated or actual work situations. The student is expected to:
- (A) inspect and identify type of finish, surface condition, and film thickness and develop and document a plan for refinishing;
 - (B) featheredge areas to be refinished;
 - (C) apply suitable metal treatment or primer;
 - (D) mask and protect other areas that will not be refinished;
 - (E) mix primer, primer-surfacer, or primer-sealer;
 - (F) identify a complimentary color or shade of undercoat to improve coverage;
 - (G) apply primer onto surface of repaired area;
 - (H) remove dust from area to be refinished, including cracks or moldings of adjacent areas;
 - (I) clean area to be refinished using a final cleaning solution;
 - (J) remove, with a tack rag, any dust or lint particles from the area to be refinished;
 - (K) apply suitable sealer to the area being refinished;
 - (L) apply stone chip resistant coating;
 - (M) identify the types of rigid, semi-rigid, or flexible plastic parts to be refinished and determine the materials needed and preparation and refinishing procedures; and
 - (N) identify metal parts to be refinished and determine the materials needed and preparation and refinishing procedures.
- (7) The student applies the technical knowledge and skills of spray gun and related components to simulated or actual work situations. The student is expected to:
- (A) inspect, clean, and determine condition of spray guns, spray environment, and related equipment such as air hoses, regulators, air lines, and air source;
 - (B) select spray gun setup, including fluid needle, nozzle, and cap, for product being applied;
 - (C) test and adjust spray gun using fluid, air, and pattern control valves; and
 - (D) demonstrate an understanding of the operation of pressure spray equipment.
- (8) The student applies the technical knowledge and skills of paint mixing, matching, and applying techniques to simulated or actual work situations. The student is expected to:

- (A) identify color code by manufacturer vehicle information label;
 - (B) measure, shake, stir, reduce, catalyze/activate, and strain refinish materials;
 - (C) apply finish using appropriate spray techniques, including gun arc, angle, distance, travel speed, and spray pattern overlap, for the finish being applied;
 - (D) apply selected product on test or let-down panel and check for color match;
 - (E) apply single stage topcoat;
 - (F) apply basecoat and clearcoat for panel blending and panel refinishing;
 - (G) apply basecoat and clearcoat for overall refinishing;
 - (H) remove nibs or imperfections from basecoat;
 - (I) refinish rigid or semi-rigid plastic parts;
 - (J) refinish flexible plastic parts;
 - (K) apply multi-stage coats for panel blending and overall refinishing;
 - (L) identify and mix paint using a formula;
 - (M) identify poor hiding colors and determine necessary action;
 - (N) tint color using formula to achieve a blendable match;
 - (O) identify alternative color formula to achieve a blendable match; and
 - (P) identify the materials, equipment, and preparation differences between petroleum and waterborne technologies.
- (9) The student applies the technical knowledge and skills of final detailing to simulated or actual work situations. The student is expected to:
- (A) apply decals, transfers, tapes, woodgrains, and pinstripes such as painted and taped;
 - (B) sand, buff, and polish fresh or existing finish to remove defects as required;
 - (C) clean vehicle interior, exterior, and glass;
 - (D) clean body openings such as door jambs and edges;
 - (E) remove overspray; and
 - (F) complete quality control using a checklist.

§130.458. Diesel Equipment Technology I (Two Credits) [~~One Credit~~], Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded two credits [~~one credit~~] for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Diesel Equipment Technology I includes knowledge of the function and maintenance [~~-, diagnosis, and service~~] of [~~major~~] diesel systems. Rapid advances in diesel technology have created new career opportunities and demands in the transportation industry. This course [~~trades and industries~~;

~~Trade and industrial education~~ provides the knowledge, skills, and technologies required for employment in transportation systems.

- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of diesel technology;
 - (B) participate in ~~demonstrate the principles of~~ group ~~participation~~ and leadership activities related to citizenship and career preparation;
 - (C) identify employers' expectations and appropriate work habits;
 - (D) identify the competencies related to resources, information systems, and technology as it pertains to diesel ~~equipment~~ technology;
 - (E) demonstrate ~~knowledge of the technical~~ knowledge and skills related to health and safety in the workplace ~~as specified by governmental regulations~~ ; and
 - (F) demonstrate workplace ethics in a variety of workplace scenarios.
- (2) The student demonstrates academic skills related to the requirements of transportation technology. The student is expected to:
 - (A) demonstrate effective oral communication skills with individuals from various cultures such as fellow students, coworkers, and customers;
 - (B) demonstrate effective written communication skills with individuals from various cultures such as fellow students, coworkers, and customers; and
 - (C) demonstrate mathematical skills ~~in performing addition, subtraction, multiplication, division,~~ and ~~precision~~ measurements using the metric and U.S. ~~standard~~ ~~customary~~ systems.
- (3) The student demonstrates technical knowledge and skills ~~that form the knowledge~~ of diesel ~~equipment technology~~ ~~services~~ . The student is expected to:
 - (A) describe the function of the major components of diesel powered vehicles such as ~~engines, fuel injection systems, lubrication, cooling, electrical, air-conditioning systems, air induction, exhaust, and emissions;~~
 - (B) describe the function of the chassis components such as braking, steering, transmission, drivetrain, suspension systems, pneumatics, and hydraulics;
 - (C) ~~demonstrate knowledge of how to~~ locate, read, and interpret documents such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair ~~information~~ ~~manuals~~ and ~~technical~~ bulletins; and
 - (D) demonstrate ~~knowledge of~~ precision measurement procedures to diagnose component wear, compare measurements to published specifications, and determine necessary repairs ~~; and~~
 - ~~(E) discuss alternative fuel vehicles;~~
- (4) The student learns the functions and applications of the tools, equipment, technologies, and materials used in diesel ~~equipment~~ service. The student is expected to:

- (A) describe [~~discuss~~] and demonstrate the safe use of hand and power tools and equipment commonly used [~~employed~~] in the diesel equipment field;
 - (B) discuss the proper handling and disposal of environmentally hazardous materials generated in the service of diesel equipment;
 - (C) describe [~~demonstrate awareness of~~] new and emerging diesel technologies;
 - (D) identify and perform [~~discuss~~] the [~~proper~~] use of diagnostic tools and equipment; and
 - (E) describe hydraulic/pneumatic [~~demonstrate awareness of fluid/pneumatic~~] properties, controls, and safety.
- (5) The student applies the technical knowledge and skills of diesel equipment technology to simulated or actual work [~~the trade to work~~] situations. The student is expected to:
- (A) describe [~~explain~~] the parts management procedures such as ordering, stocking, and locating parts;
 - (B) demonstrate procedures for removal, inspection, [~~repair~~], and replacement of engine components;
 - (C) describe [~~explain and discuss~~] procedures for inspection and maintenance of ancillary [~~service and repair of~~] systems such as braking, steering, [~~and~~] suspension, and hydraulic/pneumatic systems [~~of hydraulic and pneumatic power~~];
 - (D) demonstrate and apply the [~~an understanding of basic~~] concepts of electrical circuit testing, [~~and electronic systems such as~~], including Ohm's law, voltage drop, resistance, amperage, and voltage, as related to batteries and charging and starting systems; [~~and wiring diagram symbol~~];
 - (E) demonstrate and apply the concepts of wiring diagrams and related symbols and series and parallel circuits;
 - (F) [~~E~~] discuss [~~demonstrate an understanding of~~] the proper procedures to inspect and maintain auxillary systems such as [~~service and repair~~] air-conditioning, heating, and accessory systems;
 - (G) [~~F~~] demonstrate and apply [~~an understanding of~~] the procedures to inspect and maintain [~~service and repair~~] chassis and power train systems;
 - (H) [~~G~~] demonstrate and apply [~~an understanding of~~] the procedures to inspect and maintain [~~service and repair~~] cooling and lubrication systems; and
 - (I) [~~H~~] demonstrate an understanding of the process to perform regular audits and inspections to maintain compliance with appropriate [~~governmental~~] regulations in areas such as safety, health, emissions, and environmental protection.

§130.459. Diesel Equipment Technology II (Two Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Diesel Equipment Technology I. Students shall be awarded two credits for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

- (3) Diesel Equipment Technology II includes knowledge of the function, diagnosis, and service of ~~[major]~~ diesel equipment systems. Rapid advances in diesel technology have created new career opportunities and demands in the transportation industry. This course ~~[trades and industries. Trade and industrial education]~~ provides the advanced knowledge, skills, and technologies required for employment in transportation systems.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
- (A) identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of diesel technology;
- (B) participate in ~~[demonstrate the principles of]~~ group ~~[participation]~~ and leadership activities related to citizenship and career preparation;
- (C) identify employers' expectations and appropriate work habits;
- (D) apply the competencies related to resources, information systems, and technology as it pertains to diesel equipment technology;
- (E) demonstrate ~~[the technical]~~ knowledge and skills related to health and safety in the workplace ~~[as specified by appropriate governmental regulations]~~ ; and
- (F) demonstrate workplace ethics in a variety of workplace scenarios.
- (2) The student demonstrates academic skills related to the requirements of transportation technology. The student is expected to:
- (A) demonstrate effective oral communication skills with individuals from various cultures such as fellow students, coworkers, and customers;
- (B) demonstrate effective written communication skills with individuals from various cultures such as fellow students, coworkers, and customers; and
- (C) demonstrate mathematical skills ~~[in performing addition, subtraction, multiplication, division,]~~ and precision measurements using the metric and U.S. standard ~~[customary]~~ systems.
- (3) The student demonstrates technical knowledge and skills ~~[that form the knowledge]~~ of diesel equipment service and repair ~~[services]~~ . The student is expected to:
- (A) describe the function of the major components of diesel powered vehicles and equipment such as engines; fuel injection systems; lubrication, cooling, electrical, and air-conditioning systems; and air induction, exhaust, and emissions systems;
- (B) perform system diagnostics and failure analyses;
- (C) describe the function of the chassis components such as braking, steering, transmission, drivetrain, suspension systems, pneumatics, and hydraulics;
- (D) diagnose, repair, and replace auxiliary equipment such as power take offs, hydraulic components, and pneumatic components;
- (E) locate, read, and interpret documents such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair information ~~[manuals]~~ and technical bulletins; and
- (F) perform precision measurements and use published specifications to diagnose component wear and determine necessary repair or replacement. ~~[;and]~~

- ~~[(G) — discuss alternative fuel vehicles.]~~
- (4) The student ~~demonstrates the application~~ ~~[is aware of the functions and applications]~~ of the tools, equipment, technologies, and materials used in diesel ~~equipment diagnosis, service, and repair~~. The student is expected to:
- (A) ~~demonstrate safe use of hand and power tools and equipment commonly employed in diesel equipment technology;~~
 - (B) ~~demonstrate~~ ~~[discuss]~~ the proper handling and disposal of environmentally hazardous materials generated in the servicing of diesel equipment;
 - (C) ~~describe~~ ~~[demonstrate awareness of]~~ emerging diesel technologies;
 - (D) ~~perform~~ ~~[identify and discuss]~~ the proper use of diagnostic tools ~~and equipment~~; and
 - (E) ~~demonstrate knowledge of hydraulic/pneumatic~~ ~~[fluid/pneumatic]~~ properties, controls, and safety.
- (5) The student applies the technical knowledge and skills of ~~diesel equipment technology to simulated or actual work~~ ~~[the trade to work]~~ situations. The student is expected to:
- (A) ~~demonstrate parts inventory management such as ordering parts, stocking parts, and locating parts;~~
 - (B) ~~demonstrate procedures for the diagnosis, removal,~~ ~~[remove,]~~ repair, and ~~replacement of~~ ~~[replace]~~ engine components ~~such as cylinder heads, engine blocks, timing components, crankshafts, intake and exhaust systems, and ancillary and auxiliary systems~~;
 - (C) ~~diagnose, service, and repair diesel equipment systems such as braking, steering,~~ ~~[and]~~ suspension, ~~[systems, including]~~ pneumatic, and hydraulic ~~[powered]~~ systems;
 - (D) ~~[demonstrate service]~~ ~~diagnose~~ and repair ~~[of]~~ electrical and electronic systems ~~such as starting, charging, lighting, computer controls, and on board diagnostics systems and components such as modules, solenoids, sensors, actuators, relays, and switches~~;
 - (E) ~~demonstrate an understanding of the diagnosis,~~ service, and repair ~~of~~ air-conditioning, heating, and accessory systems;
 - (F) ~~diagnose,~~ ~~[inspect,]~~ service, and repair chassis and power train systems;
 - (G) ~~service and repair cooling and lubrication systems~~ ~~such as water pumps, oil pumps, radiators, and oil coolers~~;
 - (H) ~~use appropriate diagnostic equipment on various diesel~~ ~~equipment~~ systems; and
 - (I) ~~perform regular audits and inspections to maintain compliance with appropriate~~ ~~[governmental]~~ regulations in areas such as ~~emissions,~~ safety, health, and environmental protection.

§130.460. Energy and Power of Transportation Systems (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Transportation Systems. Students shall be awarded one credit for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related

professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

- (3) Energy and Power of Transportation Systems will prepare students to meet the expectations of employers in this industry and to interact and relate to others. Students will learn the technologies used to provide products and services in a timely manner. The businesses and industries of the Transportation, Distribution, and Logistics Career Cluster are rapidly expanding to provide new career and career advancement opportunities. Performance requirements will include academic and technical skills. Students will need to understand the interaction between various vehicle systems, including engines, transmissions, brakes, fuel, cooling, and electrical. Students will also need to understand the logistics used to move goods and services to consumers, as well as the components of transportation infrastructure.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) demonstrate the principles of group participation and leadership related to citizenship and career preparation;
 - (B) identify employers' expectations and appropriate work habits;
 - (C) identify career development, employment, and entrepreneurship opportunities and certification requirements for the field of energy and power of transportation systems;
 - (D) discuss certification requirements to meet state academic standards and qualifications for employment in selected fields of study;
 - (E) apply ethical reasoning to a variety of workplace scenarios in order to make ethical decisions;
 - (F) identify opportunities for leadership development and personal growth;
 - (G) describe and apply team dynamics principles in a project setting; and
 - (H) demonstrate effective oral and written communication skills with individuals from various cultures.
- (2) The student knows the functions and applications of the tools, equipment, technologies, and materials used in the field of energy and power of transportation systems. The student is expected to:
 - (A) discuss the safe use of hand and power tools and equipment commonly used in the maintenance and repair of engines; and
 - (B) discuss the use of audits and inspections to maintain compliance with safety, health, and environmental regulations.
- (3) The student applies technical knowledge and skills to simulated situations. The student is expected to:
 - (A) identify the major components in a vehicular system;
 - (B) identify necessary maintenance and service of vehicular systems; and
 - (C) discuss preventative maintenance plans and systems to keep vehicular systems in operation.

- (4) The student describes the historical, current, and future significance of the energy and power of transportation systems. The student is expected to:
 - (A) identify the scope and effect upon society of the energy and power of transportation systems; and
 - (B) identify potential future scenarios for the energy and power of transportation systems.
- (5) The student uses academic skills to document the requirements of the energy and power of transportation systems. The student is expected to:
 - (A) demonstrate communication skills related to working with customers, technicians, and others;
 - (B) prepare documentation such as quotes, invoices, bills of lading, work orders, and other reports;
 - (C) read and interpret appropriate documents such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair manuals and bulletins;
 - (D) perform precision measurements and use industry specifications to diagnose component shape and alignment issues and determine necessary repair;
 - (E) use critical-thinking skills to diagnose vehicular system malfunctions, solve problems, and make decisions; and
 - (F) demonstrate knowledge of regulations that govern the construction, maintenance, and service of energy and power of transportation systems.

§130.461. Management of Transportation Systems (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Transportation Systems. Students shall be awarded one credit for successful completion of this course.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) In Management of Transportation Systems, students will gain knowledge and skills in material handling and distribution and proper application, design, and production of technology as it relates to the transportation industries. This course includes the safe operation of tractor-trailers, forklifts, and related heavy equipment. This course will allow students to reinforce, apply, and transfer their academic knowledge and skills to management of transportation systems and associated careers.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
 - (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) adhere to policies and procedures;

- (B) demonstrate positive work behaviors and attitudes, including punctuality, time management, initiative, and cooperation;
 - (C) accept constructive criticism;
 - (D) apply ethical reasoning to a variety of situations in order to make ethical decisions;
 - (E) complete tasks with the highest standards to ensure quality products and services;
 - (F) model professional appearance, including dress, grooming, and personal protective equipment as appropriate; and
 - (G) comply with safety rules and regulations to maintain safe and healthy working conditions and environments.
- (2) The student demonstrates an understanding of the transportation systems. The student is expected to:
- (A) explain the history and development of the U.S. transportation systems such as railroads, highways, airports, water systems, and intermodal vans;
 - (B) examine logistics systems used for the transportation of products and services;
 - (C) define practices and terms commonly used in international sales contracts as published by the International Chamber of Commerce;
 - (D) summarize laws and regulations concerning interstate and international trade;
 - (E) explain the role of homeland security in interstate and international trade;
 - (F) evaluate risk factors and social and economic trends such as factors and trends related to risk mitigation, policy issues, security, and culture;
 - (G) evaluate documentation and other requirements for interstate and international transportation and logistics;
 - (H) describe transportation issues such as internal processing, product and supply storage, forecasting, scheduling, cost analysis, documentation confirmation, packing lists, materials safety data sheets, product seals, packaging types, packaging labels, and routing issues;
 - (I) identify employer's expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and
 - (J) demonstrate computer skills related to transportation and materials handling.
- (3) The student demonstrates an understanding of the U.S. Department of Transportation, Environmental Protection Agency, and Occupational Safety and Health Administration hazardous materials regulations. The student is expected to:
- (A) discuss U.S. Department of Transportation regulations, including procedures or policies, material designations, packaging requirements, and operational rules;
 - (B) explain U.S. Department of Transportation, Environmental Protection Agency, and Occupational Safety and Health Administration compliance requirements concerning hazardous materials, hazardous waste operations, medical surveillance, personnel training, adequate ventilation, confined space hazards, and emergency preparedness and response;
 - (C) examine personal protective equipment;
 - (D) compare specifications for accident prevention signs and tags, retention of U.S. Department of Transportation markings, and placards and labels for toxic and hazardous materials;

- (E) research handling and storage requirements for liquid fuels, liquid petroleum gas, carbon monoxide, and toxic and hazardous substances;
 - (F) examine emergency action plans, employee training requirements, evacuation procedure requirements, and facility and equipment safety standards;
 - (G) explain fire prevention resources, including portable fire extinguishers, fire management systems, employee alarm systems, and hazard communication; and
 - (H) examine fire prevention plans and documentation.
- (4) The student demonstrates an understanding of tractor-trailer knowledge and skills. The student is expected to:
- (A) read and interpret control systems;
 - (B) perform vehicle inspections and maintenance such as checking vehicle systems and components, diagnosing potential problems, and developing malfunction reports and maintenance schedules and reports;
 - (C) perform visual search and inspection of a tractor-trailer;
 - (D) demonstrate operation of tractor-trailer controls such as shifting, backing, docking, coupling and uncoupling, and adjusting vehicle speed and conduct break-down procedures;
 - (E) explain the management and adjustment of vehicle speed and space relations;
 - (F) identify potential driving hazards and environmental conditions;
 - (G) examine emergency maneuvers, procedures, and accident reports; and
 - (H) discuss appropriate decision-making procedures for planning trips.
- (5) The student demonstrates an understanding of forklift knowledge and skills. The student is expected to:
- (A) explain Occupational Safety and Health Administration forklift safety standards, including equipment operation, battery maintenance, liquid propane tank maintenance, lift truck stability, load weight limits, seat belt requirements, overhead guards, tip over prevention, and ride-out procedures;
 - (B) perform visual inspection of forklifts and their operating environment;
 - (C) discuss proper start-up, shut-down, and traveling procedures;
 - (D) perform maintenance inspections and documentation procedures;
 - (E) discuss forklift attachments; and
 - (F) evaluate proper lifting, carrying, load stability, and stacking procedures for loading trailers, boxcars, and containers.
- (6) The student demonstrates an understanding of heavy equipment knowledge and skills. The student is expected to:
- (A) explain safety issues pertaining to heavy equipment operation;
 - (B) discuss principles and maintenance of heavy equipment components, including cooling systems, fuel systems, lubrication systems, electrical systems, air systems, power systems, braking systems, pneumatic systems, hydraulic systems, [and] operator ergonomics systems, [and] tires, tracks, and track frames;
 - (C) observe the operation of heavy equipment such as bull dozers, crawler tractors, backhoes, excavators, track hoes, graders, scrapers, skid steer loaders, mini excavators, dump trucks, trenchers, cranes, hoists, soil compactors, land planes, landscaping equipment, and quarry equipment;

(D) discuss safe transportation of heavy equipment; and

(E) discuss equipment theft prevention procedures.

§130.462. Distribution and Logistics (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Recommended prerequisite: Principles of Distribution and Logistics. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

(3) Distribution and Logistics is designed to provide training for entry-level employment in distribution and logistics. This course focuses on the business planning and management aspects of distribution and logistics. To prepare for success, students will learn, reinforce, experience, apply, and transfer their knowledge and skills related to distribution and logistics.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in distribution and logistics;

(B) identify careers in distribution and logistics;

(C) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in distribution and logistics;

(D) investigate certifications required to meet state requirements for selected fields;

(E) demonstrate knowledge of personal and occupational safety, health, and first-aid policy in the workplace;

(F) develop response plans to emergency situations;

(G) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and

(H) develop personal career goals, objectives, and strategies as part of a plan for future career and educational opportunities.

(2) The student identifies concepts related to cultural diversity. The student is expected to:

(A) identify similarities and differences in international cultures;

(B) explain the variety of world markets; and

(C) describe marketing factors and practices that impact other cultures.

- (3) The student describes the historical, current, and future significance of the distribution and logistics industries. The student is expected to:
- (A) define terms associated with the distribution and logistics industries;
 - (B) identify the scope of the distribution and logistics industries and the industries' effect on society;
 - (C) identify significant historical and current issues in the distribution and logistics industries;
 - (D) identify potential future scenarios for the distribution and logistics industries;
 - (E) describe how emerging technology and globalization impacts the distribution and logistics industries; and
 - (F) compare and contrast issues affecting the distribution and logistics industries such as international trade, employment, safety, and environmental issues.
- (4) The student explains the distribution and logistics industries at local, state, national, and international levels. The student is expected to:
- (A) identify reasons for world trade and globalization;
 - (B) identify the political impact of distribution and logistics;
 - (C) review regulations and major laws to evaluate their impact on the distribution and logistics industries;
 - (D) read appropriate written material to stay abreast of current issues;
 - (E) use critical-thinking skills to identify and organize alternatives and evaluate public policy issues; and
 - (F) evaluate performance and contract compliance of contractors and service providers.
- (5) The student demonstrates appropriate personal and communication skills. The student is expected to:
- (A) describe and apply workplace ethical and legal responsibilities;
 - (B) define the uses of proper etiquette and behavior;
 - (C) identify appropriate personal appearance and health habits;
 - (D) practice written and oral communication skills and employ effective listening skills;
 - (E) comprehend technical reading materials common to the distribution and logistics industries;
 - (F) employ sound writing and preparation skills for prepared and extemporaneous oral presentations, including presentations of technical information; and
 - (G) demonstrate speaking skills.
- (6) The student applies appropriate research methods for distribution and logistics topics. The student is expected to:
- (A) define major fields of research and development;
 - (B) demonstrate proficiency in using a variety of resources for both research and development; and
 - (C) describe the scientific method of research.
- (7) The student applies problem-solving, mathematical, and organizational skills to maintain financial and logistical records. The student is expected to:
- (A) discuss project proposals;

- (B) develop and maintain records;
 - (C) collect and organize data in graphs, tables, charts, and plots;
 - (D) analyze and interpret data from graphs, tables, charts, and plots;
 - (E) maintain appropriate financial records such as journals, inventories, income and expense logs, and financial statements and balance sheets;
 - (F) conduct formative, summative, and financial analyses of project learning objectives and records in order to problem-solve for the future;
 - (G) review commercial driver license (CDL) preparation guidelines; and
 - (H) explain CDL guidelines in preparation for testing.
- (8) The student uses information technology tools to access, manage, and create information. The student is expected to:
- (A) use personal management software, email applications, and Internet applications;
 - (B) use word-processing, database, spreadsheet, and presentation software;
 - (C) use collaborative or virtual meeting software;
 - (D) use and explain the benefits of Geographic Information Systems (GIS) and Global Positioning Systems (GPS) hardware and applications;
 - (E) use computer-based equipment to manage human resources and physical assets;
 - (F) use technology applications such as barcode systems to identify and track goods and shipments; and
 - (G) use mobile applications such as GPS to track goods and shipments.
- (9) The student uses data to optimize distribution and logistics business operations such as storage, distribution routes, equipment, and human resources. The student is expected to:
- (A) use data to identify areas of operation that need improvement to optimize business operations;
 - (B) identify alternative processes and procedures to improve and optimize business operations; and
 - (C) make data-based decisions on optimizing storage space and distribution routes.
- (10) The student assesses and implements methods to reduce sources of workplace hazards common in the industry in order to promote a safe and accident-free work environment. The student is expected to:
- (A) identify, assess, and control hazards to maintain safe and healthy working conditions;
 - (B) state the role and summarize the benefits of each component in a health, safety, and environmental management system;
 - (C) demonstrate emergency procedures to reduce and mitigate workplace accidents;
 - (D) perform tool, equipment, facility, and personal protective equipment audits and inspections;
 - (E) identify rules and laws designed to promote safety and health in the workplace; and
 - (F) demonstrate knowledge of first aid and cardiopulmonary resuscitation procedures and proper use of safety equipment.
- (11) The student examines the planning, preparation, processing, handling, and storing of goods and materials in warehouses and distribution centers. The student is expected to:

- (A) determine risks or damage from normal rigors such as compression, shock, drop, moisture, corrosion, vibration, temperature, and motion during transportation and handling;
 - (B) discuss the transporting and handling of hazardous materials;
 - (C) explain size, weight, and shape requirements for packaging;
 - (D) discuss handling, storage, and shipping methods for various types of packaging and warehouse and shipping providers;
 - (E) assess requirements for various packaging types;
 - (F) analyze visual design and appearance requirements, including displaying required documentation, handling information, and warnings;
 - (G) create layout plans for processing incoming and outgoing, cross-docking, and storage of products;
 - (H) evaluate material handling and storage equipment;
 - (I) assess the processing of incoming goods and materials using standard industry protocols and procedures; and
 - (J) examine equipment and staffing requirements and develop traffic management plans and work schedules.
- (12) The student reviews issues related to interstate and international trade. The student is expected to:
- (A) define terms commonly used in sales contracts as published by the International Chamber of Commerce;
 - (B) summarize laws and regulations concerning interstate and international trade;
 - (C) explain the role of homeland security in interstate and international trade;
 - (D) evaluate risk factors and social and economic trends such as factors and trends related to risk mitigation, policy change, security, and culture;
 - (E) evaluate documentation and other requirements for interstate and international transportation and logistics; and
 - (F) describe transportation issues such as internal processing, product and supply storage, forecasting, scheduling, cost analysis, documentation confirmation, packing lists, material safety data sheets, product seals, packaging types, packaging labels, and routing issues.

§130.463. Practicum in Transportation Systems (Two Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 11 and 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Transportation, Distribution, and Logistics Career Cluster. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related

professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

- (3) Practicum in Transportation Systems is designed to give students supervised practical application of knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience such as internships, mentorships, independent study, or laboratories. The Practicum can be either school lab based or worked based.
- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as related by business and industry. The student is expected to:
 - (A) identify career development and entrepreneurship opportunities related to transportation systems;
 - (B) identify careers in transportation systems;
 - (C) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation within transportation;
 - (D) discuss certification opportunities;
 - (E) demonstrate knowledge of personal and occupational health and safety;
 - (F) discuss response plans to emergency situations;
 - (G) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and
 - (H) explore career goals, objectives, and strategies as part of a plan for future career opportunities.
- (2) The student demonstrates professional standards as required by business and industry. The student is expected to:
 - (A) adhere to policies and procedures;
 - (B) demonstrate positive work attitudes and behaviors, including demonstrating punctuality, time management, initiative, and cooperation;
 - (C) accept constructive criticism;
 - (D) apply ethical reasoning to a variety of situations in order to make ethical decisions;
 - (E) complete tasks with the highest standards to ensure quality products and services;
 - (F) model professional appearance, including using appropriate dress, grooming, and personal protective equipment; and
 - (G) comply with safety rules and regulations to maintain safe and healthy working conditions and environments in the practicum setting.
- (3) The student applies concepts of critical thinking and problem solving. The student is expected to:
 - (A) analyze elements of a problem to develop creative and innovative solutions;
 - (B) critically analyze information to determine its relevance to the problem-solving task;
 - (C) compare and contrast alternatives using a variety of problem-solving and critical-thinking skills; and

- (D) conduct technical research to gather information necessary for decision making.
- (4) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:
- (A) analyze leadership characteristics related to trusting others, maintaining a positive attitude and integrity, and accepting key responsibilities in a work situation;
- (B) demonstrate teamwork skills through working cooperatively with others to achieve tasks;
- (C) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution;
- (D) demonstrate responsibility for group and individual work tasks;
- (E) establish and maintain effective working relationships in order to accomplish objectives and tasks;
- (F) demonstrate effective working relationships using interpersonal skills;
- (G) use positive interpersonal skills to work cooperatively with others;
- (H) negotiate effectively to arrive at decisions;
- (I) demonstrate respect for individuals, including those from different cultures, genders, and backgrounds; and
- (J) demonstrate sensitivity to and value for diversity.
- (5) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:
- (A) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions;
- (B) employ verbal skills when obtaining and conveying information;
- (C) use informational texts, Internet websites, and technical materials to review and apply information sources for occupational tasks;
- (D) evaluate the reliability of information from informational texts, Internet websites, and technical materials and resources;
- (E) interpret verbal and nonverbal cues or behaviors to enhance communication;
- (F) apply active listening skills to obtain and clarify information; and
- (G) use academic skills to facilitate effective written and oral communication.
- (6) The student demonstrates technical knowledge and skills required to pursue a career in the transportation systems. The student is expected to:
- (A) develop advanced technical knowledge and skills related to the student's personal career goals;
- (B) evaluate technical skill proficiencies; and
- (C) accept critical feedback provided by the supervisor.
- (7) The student documents technical knowledge and skills. The student is expected to:
- (A) update a professional portfolio to include information such as:
- (i) attainment of technical skill competencies, licensures or certifications, recognitions, awards, and scholarships;

- (ii) extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations;
- (iii) abstract of technical competencies mastered during the practicum;
- (iv) resume;
- (v) samples of work; and
- (vi) evaluation from the practicum supervisor; and
- (B) present the portfolio to interested stakeholders.

§130.464. Practicum in Distribution and Logistics (Two Credits), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 11 and 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the distribution and logistics industry. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Practicum in Distribution and Logistics is designed to give students supervised practical application of knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience such as internships, mentorships, independent study, or laboratories. The Practicum can be either school lab based or work based.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
 - (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) adhere to policies and procedures;
 - (B) demonstrate positive work attitudes and behaviors, including punctuality, time management, initiative, and cooperation;
 - (C) accept constructive criticism;
 - (D) apply ethical reasoning to a variety of situations in order to make ethical decisions;
 - (E) complete tasks with the highest standards to ensure quality products and services;
 - (F) model professional appearance, including using appropriate dress, grooming, and personal protective equipment; and

- (G) comply with safety rules and regulations to maintain safe and healthy working conditions and environments in the practicum setting.
- (2) The student applies concepts of critical thinking and problem solving. The student is expected to:
 - (A) analyze elements of a problem to develop creative and innovative solutions;
 - (B) critically analyze information to determine its relevance to the problem-solving task;
 - (C) compare and contrast alternatives using a variety of problem-solving and critical-thinking skills; and
 - (D) conduct technical research to gather information necessary for decision making.
- (3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:
 - (A) analyze leadership characteristics related to trusting others, maintaining a positive attitude and integrity, and accepting key responsibilities in a work situation;
 - (B) demonstrate teamwork skills through working cooperatively with others to achieve tasks;
 - (C) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution;
 - (D) demonstrate responsibility for group and individual work tasks;
 - (E) establish and maintain effective working relationships in order to accomplish objectives and tasks;
 - (F) demonstrate effective working relationships using interpersonal skills;
 - (G) use positive interpersonal skills to work cooperatively with others;
 - (H) negotiate effectively to arrive at decisions;
 - (I) demonstrate respect for individuals, including those from different cultures, genders, and backgrounds; and
 - (J) demonstrate sensitivity to and value for diversity.
- (4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:
 - (A) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions;
 - (B) employ verbal skills when obtaining and conveying information;
 - (C) use informational texts, Internet websites, and technical materials to review and apply information sources for occupational tasks;
 - (D) evaluate the reliability of information from informational texts, Internet websites, and technical materials and resources;
 - (E) interpret verbal and nonverbal cues or behaviors to enhance communication;
 - (F) apply active listening skills to obtain and clarify information; and
 - (G) use academic skills to facilitate effective written and oral communication.
- (5) The student demonstrates technical knowledge and skills required to pursue a career in the distribution and logistics industries. The student is expected to:
 - (A) develop advanced technical knowledge and skills related to the student's personal career goals;

- (B) evaluate technical skill proficiencies; and
- (C) accept critical feedback provided by the supervisor.
- (6) The student documents technical knowledge and skills. The student is expected to:
 - (A) update a professional portfolio to include information such as:
 - (i) attainment of technical skill competencies, licensures or certifications, recognitions, awards, and scholarships;
 - (ii) extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations;
 - (iii) abstract of technical competencies mastered during the practicum;
 - (iv) resume;
 - (v) samples of work; and
 - (vi) evaluation from the practicum supervisor; and
 - (B) present the portfolio to interested stakeholders.

§130.465. Extended Practicum in Transportation Systems (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 11 and 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Transportation, Distribution, and Logistics Career Cluster. Corequisite: Practicum in Transportation Systems. This course must be taken concurrently with Practicum in Transportation Systems and may not be taken as a stand-alone course. Students shall be awarded one credit for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Extended Practicum in Transportation Systems is designed to give students supervised practical application of knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience such as internships, mentorships, independent study, or laboratories. Extended Practicum in Transportation Systems can be either school lab based or worked based.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
 - (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

- (A) participate in a paid or unpaid, laboratory- or work-based application of previously studied knowledge and skills related to transportation systems;
 - (B) participate in training, education, or preparation for licensure, certification, or other relevant credentials to prepare for employment;
 - (C) demonstrate professional standards and personal qualities needed to be employable such as self-discipline, positive attitude, integrity, leadership, appreciation for diversity, customer service, work ethic, and adaptability with increased fluency;
 - (D) use personal information management, email, Internet, writing and publishing, presentation, and spreadsheet or database applications with increased fluency;
 - (E) employ teamwork and conflict-management skills with increased fluency to achieve collective goals; and
 - (F) employ planning and time-management skills and tools with increased fluency to enhance results and complete work tasks.
- (2) The student implements advanced professional communications strategies. The student is expected to:
- (A) demonstrate verbal and non-verbal communication consistently in a clear, concise, and effective manner;
 - (B) analyze, interpret, and effectively communicate information, data, and observations;
 - (C) observe and interpret verbal and nonverbal cues and behaviors to enhance communication; and
 - (D) apply active listening skills to obtain and clarify information.
- (3) The student applies concepts of critical thinking and problem solving. The student is expected to:
- (A) employ critical-thinking skills with increased fluency both independently and in groups to solve problems and make decisions;
 - (B) analyze elements of a problem to develop creative and innovative solutions; and
 - (C) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions.
- (4) The student understands and applies proper safety techniques in the workplace. The student is expected to:
- (A) understand and consistently follow workplace safety rules and regulations, including Occupational Safety and Health Administration regulations; and
 - (B) demonstrate knowledge of procedures for reporting and handling accidents and safety incidents.
- (5) The student understands the professional, ethical, and legal responsibilities in transportation systems. The student is expected to:
- (A) demonstrate a positive, productive work ethic by performing assigned tasks as directed;
 - (B) apply ethical reasoning to a variety of situations in order to make ethical decisions; and
 - (C) comply with all applicable rules, laws, and regulations in a consistent manner.
- (6) The student participates in a transportation systems experience. The student is expected to:
- (A) conduct, document, and evaluate learning activities in a supervised transportation systems experience;
 - (B) develop advanced technical knowledge and skills related to the student's occupational objective;

- (C) demonstrate growth of technical skill competencies;
- (D) evaluate strengths and weaknesses in technical skill proficiency; and
- (E) collect representative work samples.

§130.466. Extended Practicum in Distribution and Logistics (One Credit), Adopted 2015.

- (a) General requirements. This course is recommended for students in Grades 11 and 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Transportation, Distribution, and Logistics Career Cluster. Corequisite: Practicum in Distribution and Logistics. This course must be taken concurrently with Practicum in Distribution and Logistics and may not be taken as a stand-alone course. Students shall be awarded one credit for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
 - (3) Extended Practicum in Distribution and Logistics is designed to give students supervised practical application of knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience such as internships, mentorships, independent study, or laboratories. Extended Practicum in Distribution and Logistics can be either school lab based or work based.
 - (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
 - (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
- (c) Knowledge and skills.
 - (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) participate in a paid or unpaid, laboratory- or work-based application of previously studied knowledge and skills related to distribution and logistics;
 - (B) participate in training, education, or preparation for licensure, certification, or other relevant credentials to prepare for employment;
 - (C) demonstrate professional standards and personal qualities needed to be employable such as self-discipline, positive attitude, integrity, leadership, appreciation for diversity, customer service, work ethic, and adaptability with increased fluency;
 - (D) use personal information management, email, Internet, writing and publishing, presentation, and spreadsheet or database applications with increased fluency;
 - (E) complete tasks with the highest standards to ensure quality products and services;
 - (F) employ teamwork and conflict-management skills with increased fluency to achieve collective goals; and

- (G) employ planning and time-management skills and tools with increased fluency to enhance results and complete work tasks.
- (2) The student implements advanced professional communications strategies. The student is expected to:
 - (A) demonstrate verbal and non-verbal communication consistently in a clear, concise, and effective manner;
 - (B) analyze, interpret, and effectively communicate information, data, and observations;
 - (C) observe and interpret verbal and nonverbal cues and behaviors to enhance communication; and
 - (D) apply active listening skills to obtain and clarify information.
 - (3) The student applies concepts of critical thinking and problem solving. The student is expected to:
 - (A) employ critical-thinking skills with increased fluency both independently and in groups to solve problems and make decisions;
 - (B) analyze elements of a problem to develop creative and innovative solutions; and
 - (C) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions.
 - (4) The student understands and applies proper safety techniques in the workplace. The student is expected to:
 - (A) understand and consistently follow workplace safety rules and regulations, including Occupational Safety and Health Administration regulations; and
 - (B) demonstrate knowledge of procedures for reporting and handling accidents and safety incidents.
 - (5) The student understands the professional, ethical, and legal responsibilities in distribution and logistics systems. The student is expected to:
 - (A) demonstrate a positive, productive work ethic by performing assigned tasks as directed;
 - (B) apply ethical reasoning to a variety of situations in order to make ethical decisions; and
 - (C) comply with all applicable rules, laws, and regulations in a consistent manner.
 - (6) The student participates in a distribution and logistics experience. The student is expected to:
 - (A) conduct, document, and evaluate learning activities in a supervised distribution and logistics experience;
 - (B) develop advanced technical knowledge and skills related to the student's occupational objective;
 - (C) demonstrate growth of technical skill competencies;
 - (D) evaluate strengths and weaknesses in technical skill proficiency; and
 - (E) collect representative work samples.